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POLLUTION OF LAKE SUPERIOR AND ITS TRIBUTARY BASIN-MINNESOTA-WISCONSIN-MICHIGAN. SESSION (2ND) (RECONVENED) PROCEEDINGS OF CONFERENCE HELD AT DULUTH, MINNESOTA ON AUGUST 12-13, 1970. VOLUME II

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PROCEEDINGS

LAKE SUPERIOR
MINNESOTA
MICHIGAN
WISCONSIN

Second Session (Reconvened)
Duluth, Minnesota
August 12-13, 1970

Volume 2

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CONFERENCE

In the Matter of Pollution of Lake Superior and its Tributary Basin-Minnesota-Wisconsin-Michigan

Reconvening of

SECOND SESSION

OF THE

CONFERENCE

IN THE MATTER OF POLLUTION OF LAKE SUPERIOR

AND ITS TRIBUTARY BASIN

IN THE STATES OF MINNESOTA, WISCONSIN, AND MICHIGAN

held in

Duluth, Minnesota

August 12-13, 1970

TRANSCRIPT OF PROCEEDINGS

START. 453

Evaluation of the Current Technical Information on the Effect of Reserve Mining Company's Discharge of Taconite Tailings on Water Quality in Lake Superior, by:

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INTRODUCTION:

The Reserve Mining Company discharges approximately 67,000 short tons of taconite tailings to Lake Superior per day. This firm was issued permits by the Minnesota Water Pollution Control Commission, Minnesota Department of Conservation, and the U.S. Corps of Engineers to discharge taconite tailings to the lake in the current manner prior to the construction of a 350,000,000 dollar processing plant at Silver Bay, Minnesota.

In the fifteen years of operation of this plant, the Minnesota Pollution Control Agency, its predecessor, Water Pollution Control Commission, Minnesota Department of Conservation, and the Minnesota Department of Health have made repeated investigations of the effect of Reserve's discharge on water quality in Lake Superior. Each of these investigations have resulted in a report which stated that no material damage to water quality of Lake Superior had or was occurring as a result of Reserve's discharge.

In the past two years, a large number of federal, state, university, industrial and private studies have been conducted on the effects or potential effects of the discharge of taconite tailings by the Reserve Mining Company on water quality in Lake Superior. The purpose of this paper is to review the current state of technical knowledge in this area.

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[1] Consultant for the Reserve Mining Company.

Hopefully, this evaluation will enable the Conferees to give proper weight to the technical information available upon which appropriate decisions can be made.

BACKGROUND INFORMATION:

Silver Bay, Minnesota, is located at about sixty miles northeast of Duluth, Minnesota. The Reserve Mining Company is located on the shore of the lake at Silver Bay. The company mines taconite* at Babbitt, Minnesota, approximately forty-seven miles inland and hauls the crushed ore, less than four-inch diameter, by its own railroad to Silver Bay for further processing. Processing consists of further crushing and wet grinding of the ore to a fine slurry. The magnetic particles present in the rock are removed from the slurry by hydraulic and magnetic separation. These particles are formed into small spherical balls and are heated to a high temperature to form taconite pellets which are shipped via ore vessels to blast furnaces on the lower Great Lakes. The non-magnetic particles in the rock (tailings) are transported to the shore of the lake by water carriage where they are discharged. This discharge has formed a large delta where approximately 45 percent of the tailings particles are removed by settling before reaching the lake. During the fifteen years of operation of the plant the delta has developed to the point where it is currently about one mile wide at its face and extends about one-half mile into the lake to an island which forms part of Reserve's harbor.

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*The taconite rock available to the Reserve Mining Company at its Babbitt mine is an extremely hard, highly resistant suite of silicate minerals which contains small amounts of magnetic iron particles. The principle minerals in the ore are quartz, cummingtonite, and magnetite.

The processing of taconite rock as practiced by the Reserve Mining Company requires about 415,000 gallons per minute of water. The tailings discharge slurry contains about 14,000 parts per million of suspended solids. This slurry runs as a thin (less than 6 inches thick) film over the delta. Upon reaching the edge of the delta, it forms a density current which has a velocity in the order of 1 to 2 feet per second. The density current carries the suspended solids present in the discharge slurry down the face of the delta to the bottom of the lake, about 900 feet below the surface of the lake. The morphology of Lake Superior in the region of discharge is such that a large trough is present immediately adjacent to the point of discharge. This trough is about 24 miles long and 2.5 miles wide at the 900-feet depth.

DISTRIBUTION OF TACONITE TAILINGS IN LAKE SUPERIOR:

At previous conferences considerable discussion was focused on a claim that large amounts of tailings added to the lake during the first 15 years of operation of the Reserve Mining Company could not be accounted for using Reserve's data. At the time of the presentation of this data, it was pointed out by the Company that these calculations did not include the amounts of tailings present in the toe of the delta, and, without this type of information it was impossible to make any reliable estimate on the distribution of taconite tailings in the lake.

About one year ago, Reserve initiated an extensive sampling program to define the location of tailings discharged to the lake. These studies are essentially completed at this time and show that over 90% of the tailings added to the lake during the first 15 years of operation are located on the delta and on the bottom of the lake within the 9 square mile permit zone of discharge. It is important to point out that Reserve's permit does not restrict tailing deposition to the permit zone. It was recognized at the time the permits were issued by the state of Minnesota that tailings would be carried by the density current to the bottom of the lake and be deposited within the deep trough area along the North shore of Lake Superior. The recently completed studies show that in excess of 98.5% of the tailings added to Lake Superior during the first 15 years of operation are accounted for on the delta on the bottom in the discharge permit zone and the deep trough. The currently available data clearly shows that the taconite tailings discharged by the Reserve Mining Company are going exactly where it was originally predicted in that they are being deposited -- primarily, on the delta in the zone of discharge adjacent to the plant and in the deep trough.

It is estimated that the bottom of this deep trough will be raised approximately 30 inches when all of the currently available, mineable ore of the Reserve Mining Company has been processed from their mine located at Babbitt, Minnesota. In a sense, Reserve Mining Company as a result of the discharge of taconite tailings to Lake Superior is taking approximately 30 inches out of the deep trough area located along the Northshore of the lake where the total depth of the lake is in excess of 900 feet. It is reasonable to ask whether or not this 30 inches represents a significant increase in the rate of filling Lake Superior. The answer to this question can be assessed in terms of the normal expected rates of filling of the lake. Based on the best estimates available today, Lake Superior should be completely filled in about one and a half million years. The filling of the deep trough by the Reserve Mining Company to the extent of 30 inches will not make a significant measurable decrease in the expected life of this lake.

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OCCURRENCE OF GREEN WATER:

From a hydrodynamics point of view, the discharge of taconite tailings is following exactly the predicted behavior of the density current in that the tailings are being carried to the deep trough where they settle on the bottom. From a water quality point of view, however, it is estimated that a very small amount of tailings are temporarily dispersed in the surface or near surface waters as a result of the escape of some tailings from the density current as well as a temporary transport of tailings deposited on the face of the delta during certain storm and other meterological conditions. Independent of the mechanism by which small amounts of taconite tailings become associated with the surface waters of Lake Superior outside of the zone of discharge granted to the Company by the State of Minnesota permit, there is no doubt that these tailings do contribute to the presence of green water along the Northshore of Lake Superior in the vicinity of the plant. This green water is caused by the scattering of light from finely divided suspended materials in the surface waters of the lake. Various studies have shown that the amounts of suspended solids present in the green water areas of the lake is in the amount of a few turbidity (JTU) units. This amount of suspended solids would not be detectable in most lakes of the world. However, because of the extreme clarity of Lake Superior water, it is detectable along the Northshore of the lake. It is also clear that green water is caused by natural discharges of suspended solids by the various tributary streams along the Northshore as well as the Southshore of the lake. In other words, green water was present prior to the time of the initiation of operation of the Reserve Mining Company. Reserve's operation increases the frequency of green water. However, there is no data available today which provides any technical basis upon which a reasonable estimate of the increase in the frequency of green water along the Northshore that can be attributed to Reserve's discharge of taconite tailings. It is important to point out that green water is not continuously present along the Northshore and that all green water present in Lake Superior is not due to Reserve's discharge.

The presence of green water along the Northshore does decrease light penetration and thereby could potentially decrease the amounts of Periphyton (attached algae) along a narrow band of the bottom of the lake. However, because of the steepness of the slope of the bottom along the Northshore of Lake Superior as well as the fact that the green water is present from all causes at infrequent intervals during the year, it is highly unlikely that the possible decrease in periphyton would have any effect on the ecology of Lake Superior and certainly would not cause any deterioration in water quality of this body of water.

DISTRIBUTION OF TACONITE TAILINGS FINES IN LAKE SUPERIOR BASIN:

As pointed out above, essentially all of the taconite tailings discharged to Lake Superior by the Reserve Mining Company are deposited either on the delta or in the deep trough of the lake along the Northshore. However, a small amount of the taconite tailings may be carried for some distances in the lake. It is reasonable to ask what would be the effect of these taconite tailings on water quality in Lake Superior. Before the consideration of the answer to this question, it is appropriate to review the current state of information on the distribution of taconite tailings in the lake. Studies by the FWQA and Reserve Mining Company have shown that cummingtonite, a principle component of taconite tailings, is carried to Lake Superior by many of the tributary streams. In fact, the suspended solids carried to the lake contain in the order of a few percent cummingtonite. Therefore, any attempt to use trace amounts of cummingtonite as an indicator of the areas of deposition of taconite tailings discharged by the Reserve Mining Company would be in error unless consideration is given to the natural sources of this mineral. Cummingtonite is an iron-magnesium-silicate mineral and from a water quality point of view, its presence in water is no different than the presence of quartz, or other finely divided silicate minerals.

The FWQA has attempted to define the distribution of taconite tailings in Lake Superior. They have used cummingtonite as a tracer for these tailings. In general, the results of their studies have confirmed with the results of the Reserve Mining Company in showing that the principle location for the deposition of tailings is in the deep trough of the lake. However, the FWQA has reported that taconite tailings discharged by the Reserve Mining Company are being deposited in localized areas along the Wisconsin shore of Lake Superior. This conclusion is based on the fact that they found in several cores of lake sediments located near the Wisconsin shore concentrations of cummingtonite above the natural background levels normally found in cores outside of the zone of active deposition of taconite tailings. In other words, they propose that taconite tailings are deposited in localized areas in a discontinuous (spotty) manner along the Wisconsin shore. However, I feel that the evidence that they present to substantiate this conclusion is insufficient. There is little doubt in my mind that small amounts of taconite tailings do cross the Minnesota-Wisconsin state line. However, finding cummingtonite at concentrations above the background levels normally found in

Lake Superior along the Wisconsin shore should not be interpreted as evidence for the fact that taconite tailings are being carried in large amounts to these areas. I have found that the near shore environments of lake sediments often are highly heterogeneous. The chemical and mineralogical composition of lake sediments is highly variable and dependent upon the location with respect to the various tributary streams, lake currents, etc. Until such time as further studies are available on the distribution of cummingtonite along the Wisconsin shore, I would not accept the conclusion that Reserve's discharge results in the accumulation of tailings along the Wisconsin shore in measurable amounts.

One of the most significant factors to be considered with regard to the distribution of taconite tailings in Lake Superior is that just because tailings are found to cross a political boundary such as a state line, this does not mean that there is presumptive evidence for a deterioration in water quality. There has been a tendency in previous Lake Superior Enforcement Conferences to equate the transport of tailings across a political boundary to deteriorated water quality. There is no reason to believe per se that the small amounts of tailings which may cross a state line would cause deteriorated water quality.

EFFECT ON WATER SUPPLIES:

One of the most important considerations that should be given to the potential effect the discharge of taconite tailings may have on water quality of Lake Superior is the possible effect on municipal water supplies. It is clear from the evidence available from various water plant records that the discharge of taconite tailings to Lake Superior by the Reserve Mining Company has not caused a deterioration in water quality for the various water supplies located along the Northshore of the lake nor in any other region of the lake. Examination of the water supply records for turbidity as well as length of filter runs substantiate this. Water quality along the Northshore of Lake Superior is among the highest in the world from all points of view including turbidity, bacterial quality as well as chemical composition. There is no evidence that this water quality has been deteriorating in the last 15 to 20 years from any cause.

THE EFFECT OF THE DISCHARGE OF TACONITE TAILINGS ON THE BACTERIAL QUALITY OF LAKE SUPERIOR:

The FWQA has presented several laboratory studies which allege that the discharge of taconite tailings would have an effect on the bacterial growth. While it is true that taconite tailings could act as a platform for the attachment of bacterial food as well as bacteria present in natural waters, the studies conducted thus far do not in my opinion demonstrate that the small amounts of taconite tailings that may become associated with the surface waters of Lake Superior would cause any measurable increase in the numbers of pathogenic bacteria present in the lake. Some of the laboratory studies by the FWQA show that large amounts of tailings are necessary to even detect an effect on the numbers of bacteria present under laboratory cultural conditions. The concentrations of tailings used in these studies are considerably in excess of any concentrations of tailings that would ever be associated with the surface waters of Lake Superior outside of the zone of discharge of the Reserve Mining Company. In order to place the potential effects of taconite tailings on bacterial water quality in Lake Superior in its proper perspective, it is necessary to assume that future studies in this area will show that taconite tailings may act as a platform upon which bacteria present in the lake may become attached and, thereby, increase in number over those that are freely suspended in lake water. Taconite tailings do not contain any source of bacterial food that can be used by the common pathogenic water bacteria for their growth. The food or organic matter needed for the growth of these organisms must be provided from the water itself or other sources. Previous studies on the distribution of bacteria in natural waters have shown that the majority of the bacteria present in natural waters are associated with solids surfaces. The majority of these studies have shown that there are very few freely suspended bacterial organisms in most natural waters. The particulate matter present in natural waters such as the dead remains of aquatic organisms or the detritus brought in from the watershed as well as the inorganic mineral debris suspended in all surface waters does act as a point of attachment for bacteria. There is no evidence to show that taconite tailings would tend to stimulate the growth of bacteria more than natural particulate matter that is present in all surface waters. In fact, if one had to speculate the relative importance of taconite tailings versus the remains of dead organisms such as algal cells, organic aggregates, etc., I believe most individuals would state that the organic remains of organisms would be a much more suitable type of particulate matter for stimulation of bacterial growth than taconite tailings.

In order to understand the potential significance of taconite tailings on bacterial numbers in Lake Superior, it is important to point out that there is no bacterial problem in Lake Superior today nor is there any reason to believe that continued discharge of taconite tailings to Lake Superior would cause a problem at some future date. If we consider the types of particulate matter present in the surface waters of Lake

Superior outside of the zone of discharge of Reserve Mining Company we would find that the principle types of particulate matter present in the surface waters of the lake at a distance of a few miles from the point of discharge from Reserve Mining Company would be other than taconite tailings. In fact, the amount of taconite tailings present in the suspended matter present in waters across the Minnesota-Wisconsin state line is such that the currently available techniques for the detection of taconite tailings cannot find them in the suspended solids of the lake. This clearly means that principle components of suspended solids on the Wisconsin side of Lake Superior as well as the Minnesota and Michigan part of the lakeare particles other than taconite tailings. Therefore, since these particles would be expected to stimulate bacterial growth at least equal to and possibly to a greater extent than taconite tailings, it is incorrect to assume that there is any evidence to show that taconite tailings is having any deleterious effect on water quality in Lake Superior with regard to bacterial numbers. In fact, studies by the Reserve Mining Company have shown that the water taken into the plant from Lake Superior contains much larger numbers of bacteria than the waters discharged from the plant. In other words, bacteria present in the intake waters are killed as a result of the grinding operations within the plant as well as the large hydrodynamic stress under which they are placed as a result of high speed pumping of the taconite slurry.

Since the waters discharged from Reserve Mining Company onto the delta are carried by the density current to the bottom of Lake Superior, Reserve's operation is tending to improve bacterial water quality in the region of discharge of the plant. Bacteria present in the intake of the plant are destroyed as a result of Reserve's processes and those that survive the grinding processes are carried to the bottom of the lake. The concentrations of bacteria found in the intake waters of Reserve Mining Company are not of abnormally high for the Northshore of Lake Superior. Studies have shown that these bacteria are predominantly derived from various tributary streams discharging in the region of Silver Bay as well as from boats and seagulls and treated and untreated sewage.

EFFECT OF TACONITE TAILINGS ON THE EUTROPHICATION OF LAKE SUPERIOR: Various claims have been made that discharge of taconite tailings to Lake Superior by the Reserve Mining Company will increase the rate and degree of eutrophication of this lake and, therefore, accelerate its rate of aging. It is clear that there has been no evidence produced to date which shows that the discharge of taconite tailings by Reserve Mining Company is in fact increasing the eutrophication of Lake Superior. There have been a number of laboratory studies by the FWQA and others which purport to show that taconite tailings will stimulate the growth of algae. Examination of the data presented in these various studies shows that many of the results are not statistically valid, or that insufficient data was available upon which to make any reliable estimate of the potential effects of taconite tailings on the growth of algae or that very large concentrations of tailings were needed to demonstrate any stimulatory effect. If we assume that further studies would produce valid results, which show the same general trends as the existing studies we still have the problem of reconciling the differences between these studies with regard to the effects of the amounts of tailings on the growth of algae. Several of these studies show that a small amount of tailings stimulate the growth of algae while larger amounts do not and, in fact, may actually inhibit algal growth. However, other studies have shown that larger amounts of tailings are needed before any stimulation is found. In my opinion, it is fair to state at this time that the laboratory results produced thus far are extremely confusing and cannot be used to substantiate the claims that the discharge of taconite tailings will stimulate the growth of algae in Lake Superior. It is also my opinion, that further laboratory studies may show that taconite tailings may effect the growth of algae under laboratory conditions. However, these studies should not be interpreted to mean that these effects will occur in Lake Superior. There are considerable differences between laboratory conditions than those that occur in the lake. It is a well known fact that extreme caution must be used in translating laboratory results to field conditions. It is mistakenly believed by some that laboratory studies which show an algal stimulation in the presence of large amounts of taconite tailings such as those reported by the FWQA at the April, 1970, Lake Superior Conference, can be used to infer what might happen in Lake Superior. In these particular studies, the concentration of taconite tailings needed to show a statistically significant stimulatory effect of algal growth above that found in the control without tailings would only be found in the density current at considerable depths in the lake. Under these conditions, algal growth would not occur because of a lack of sunlight.

The sorption of phosphorus by taconite tailings provides an example of why caution must be used in translating preliminary laboratory results to lake conditions. At the May, 1969, Lake Superior Enforcement Conference, I reported on preliminary laboratory results of the Reserve Mining Company which showed that taconite tailings will sorb or remove phosphorus from Lake Superior waters. This finding was of great potential significance to Lake Superior since based on the composition of the lake water, it was highly likely that algae populations present in the lake are limited by phosphorus. This means that it was conceivable that rather than stimulating algal growth the discharge of taconite tailings would tend to reduce algal growth due to the removal of essential nutrients from the surface waters of the lake. After the May, 1969, Enforcement Conference, I had Reserve continue studies in this area to determine whether the preliminary results would be expected to occur within the lake. As a result of these additional studies it has been found that although large concentrations of taconite tailings tend to remove phosphorus and, therefore, reduce the possible eutrophication of the lake, the concentrations of taconite tailings that are likely to occur outside of the density current are such that when compared to the concentrations of all the phosphate present in the lake, the amount of sorption that might occur would be insignificant. Therefore, although the preliminary laboratory results showed a tendency for a certain type of reaction to occur, when investigated at realistic levels for the lake, this tendency was shown to be insignificant. The same kind of situations may occur with interpreting the stimulatory effects of taconite tailings on the growth of algae. It is certainly possible to create unrealistic laboratory conditions whereby the various elements present in taconite tailings could become available for algae growth. However, these results should not be taken as conclusive evidence that discharge of taconite tailings in Lake Superior will cause eutrophication problems.

Some recent studies on factors influencing the growth of algae in Lake Superior demonstrate that phosphorus is one of the major controlling elements in this lake which influences algal populations. These same studies also showed that silica probably does not limit algal growth in Lake Superior. These results are somewhat in opposition to previous claims made by the FWQA at the April, 1970, Enforcement Conference where they claimed that silica was limiting algal growth in Lake Superior. From an overall point of view, it can be stated that there is no evidence available today to show the discharge of taconite tailings is increasing eutrophication of Lake Superior. Also, the available evidence indicates that during the fifteen years of operation of the Reserve Mining Company there has not been a significant increase in the algal populations in this lake. In my opinion, if such increases were noted, it is much more likely that they would be due to the discharge of municipal waste waters which contain large amounts of phosphorus from the metropolitan areas located in the Lake Superior water basin than the Reserve Mining Company. This statement is based primarily on some recent work conducted by the author on the availability of phosphorus present in taconite tailings, to promote algal growth. As mentioned above, all available evidence indicates that phosphorus is probably one of the key limiting elements controlling algal populations in Lake Superior. It is well known that taconite tailings do contain measurable quantities of phosphorus. Therefore, potentially there could be a problem as a result of discharge of taconite tailings to Lake Superior water in stimulating algal growth if the phosphorus present within taconite tailings would become available for use by algae. In order to investigate whether or not the phosphorus present in taconite tailings could readily become available for algal growth, a number of studies had been conducted in the author's laboratory. These studies have shown that the phosphorus present in taconite tailings is not readily available for algal growth.

SOLUBILITY OF TACONITE TAILINGS IN LAKE SUPERIOR WATERS:

One of the potentially significant effects of the discharge of taconite tailings to Lake Superior is an increase in dissolved solids in the lake. While data available today show that in range of 100,000 lbs of dissolved solids are added to Lake Superior each day from Reserve's discharge, data of this type should not be used to infer that there will be a measurable increase in dissolved solids in Lake Superior as a result of Reserve's operations. First, it should be remembered that in excess of several million pounds per day of dissolved solids enter Lake Superior from the various tributary streams; secondly, all available evidence indicates that there has been no change in dissolved solids content of Lake Superior during the recorded history of the lake. Also, various studies have shown concentrations of dissolved solids in the vicinity of Silver Bay, where Reserve's discharge takes place, are the same as for other parts of Lake Superior. There has been no increase in dissolved solids in Lake Superior as a result of Reserve's fifteen years of operation. There are laboratory leaching tests conducted by both the FWQA and Reserve which show that there are increases in dissolved solids from taconite tailings. However, when the results of these tests are put in perspective of Lake Superior and certain reasonable assumptions are made with regard to the amount of leaching of dissolved solids which might occur after the tailings have been deposited in the lake, we find that after fifty years of operation the dissolved solids in Lake Superior would be increased in the order of a few tenths of a milligram per liter. The existing concentrations of dissolved solids in Lake Superior is approximately 57.50 milligrams per liter. After fifty years of operation, the dissolved solids content would be in the order of 57.6 to 57.7 milligrams per liter. Such a small change would not be detectable by the normal analytical procedures used to measure dissolved solids in natural waters. Therefore, the large concentrations of dissolved solids released during laboratory leaching tests when put into perspective of the large volumes of water available for dilution of these solids in Lake Superior show that there would be no measurable increase in dissolved solids in the lake. This type of calculation is based on a fairly complete mixing of Lake Superior water. Some have claimed that it is unreasonable to assume fairly complete mixing of the lake. However, if similar calculations are made in which you assume little or no mixing of Lake Superior water, a significant increase in dissolved solids content in the region of Silver Bay would have been detected. Such an increase has not occurred during the fifteen years of operation of the plant.

TOXICITY OF TACONITE TAILINGS:

The FWQA Appraisal Report distributed at the May, 1969, Lake Superior Enforcement Conference suggested that the discharge of taconite tailings to Lake Superior could cause problems of toxicity to aquatic organisms because of the presence of various toxic metals in the tailings, such as copper, zinc, nickel, etc. All available evidence produced prior to and after the issuance of this report shows that the potentially toxic metals present in taconite tailings are not available to aquatic organisms in sufficient concentrations to be toxic to them. The only possible exception to this statement was some work by the FWQA in which it was found that potential toxicity problems did occur in concentrated tailings such as might be found in the density current. Even with these studies, it is doubtful that the potentially toxic metal present in tailings were the cause of the toxicity. All available evidence shows that the discharge of taconite tailings to Lake Superior as practiced by the Reserve Mining Company will not cause any toxicity problems to aquatic organisms or other forms of life in Lake Superior. These results show that it is incorrect to analyze the total amounts of copper, zinc, nickel, etc., present in taconite tailings and to establish water quality criteria which would be applicable to tailings based on these totals. In order for water quality criteria to be meaningful, i.e., to protect water quality without undue hardship on the users of the water the criteria must be based on what can become available to the organisms and thereby effect them. It is certainly incorrect to consider taconite tailings like other types of suspended solids that are normally encountered in water pollution studies since these materials are highly inert silicate minerals which tend to hold tightly bound within the crystalline structure the various chemical species which could effect water quality.

BOTTOM FAUNA:

Previous sessions of the Lake Superior Enforcement Conferences have focused on question of the effects of the discharge of taconite tailings on bottom fauna in Lake Superior. In fact, I believe that one of the reasons given in support of the statement for presumptive evidence that there is a deleterious effect from tailings on water quality in states other than the state where the discharge takes place with regard to Reserve's discharge of taconite tailings was based on changes in the bottom fauna. While evidence has been presented which showed, based on a limited study by the Minnesota Department of Conservation that there were apparent changes of bottom fauna in the region of Reserve's discharge. Subsequent studies have demonstrated that the initial results were based on an insufficient number of samples to be considered statistically reliable. While it is possible that the numbers and distribution of pontoporeia and other bottom organisms were being changed somewhat in the areas of taconite deposition, as compared to non-deposition areas, however, the discharge of taconite tailings to Lake Superior has not caused great changes in bottom fauna of the lake. Any changes that occur would be very difficult to detect and would require large numbers of samples in order to establish the quantitative magnitude of these changes. Qualitatively, the available data showed that the discharge of taconite tailings does not significantly alter the bottom fauna present in Lake Superior. Even if future studies on the bottom fauna of Lake Superior in the region of discharge of taconite tailings did show that minor changes do occur in the composition of the bottom fauna as a result of Reserve's discharge, these minor changes would not be necessarily interpreted as a deleterious effect on water quality.

There are some who tend to equate any change in the composition of water or the organisms that occur within it as a significant deleterious effect on water quality. Certainly, there is no technical basis for saying that because the number of pontoporeia or other bottom fauna organism changes by a few percent that this represents a significant effect on water quality in the lake. The overall role of bottom fauna in the ecology of a lake is poorly understood. It is unreasonable to state that changes in the bottom fauna of the order that are likely to occur as a result of Reserve's discharge would have a significant deleterious effect on water quality or ecology of Lake Superior.

THE EFFECT OF TACONITE TAILINGS ON FISH IN LAKE SUPERIOR:

There have been marked changes in the fisheries of Lake Superior in the past twenty to thirty years. Studies by various governmental agencies have shown that these changes cannot be associated with the discharge of taconite tailings to Lake Superior. There is no evidence available today that shows that Reserve's discharge has any deleterious effect on the fisheries of the lake.

CONCLUSION:

A critical review of technical information available today shows that the Reserve's discharge of taconite tailings to Lake Superior does not have a significant deleterious effect on water quality in Lake Superior for any beneficial use of the lake. The only potential adverse effect of this firm's discharge is that it may increase the frequency of green water in the region of Silver Bay, Minnesota. Therefore, the current technical information on the effects of taconite tailings on water quality in Lake Superior must be viewed in terms of the effects on the esthetic quality of the water in the region of Silver Bay. In my opinion, there is no evidence to show that the discharge of taconite tailings to Lake Superior is having a deleterious effect on water quality in the states of Wisconsin or Michigan.

REPORT ON INVESTIGATION
OF WATER QUALITY OF LAKE SUPERIOR
IN THE VICINITY OF SILVER BAY

November 3-7, 1969

MINNESOTA POLLUTION CONTROL AGENCY

Division of Water Quality
Section of Standards and Surveys

MINNESOTA POLLUTION CONTROL AGENCY
Division of Water Quality
Section of Standards and Surveys

Report on Investigation of Water Quality of Lake Superior in the Vicinity of Silver Bay

November 3-7, 1969

CONCLUSIONS

1. The overall water quality of Lake Superior at the time of the survey in the vicinity of Silver Bay was found to be excellent at all sampling stations.
2. No significant difference was found in the quality of the water outside of the Reserve Mining Company permit area and that inside the area at the time of the survey, except for the 5-day biochemical oxygen demand which was significantly higher outside the area. These higher values are probably attributable to the rivers flowing into the lake south of the permit area.
3. One sample taken approximately 15 miles southwest of the permit area had a lead concentration slightly in excess of the limit prescribed for Lake Superior by Regulation WPC 15. There was no apparent reason for this high value, and further investigative work is indicated to establish its significance.
4. Every effort should be made to preserve the excellent quality of the lake.

PURPOSE AND SCOPE OF THE INVESTIGATION

The investigation was for the purpose of determining if the water quality in and around the Reserve Mining Company permit area was being affected by the discharge of taconite tailings, and to provide current information for comparison with the results of similar surveys done in 1948, 1953, 1955, 1958 and 1966.

It was the intention originally to take samples from the 5, 20 and 100 foot depth at 26 sampling stations for analysis of a variety of parameters. During the course of the survey, however, the number of stations was reduced to 24, and samples were taken at the 100 foot depth at only 7 stations because of unsettled weather. The location of the stations is shown in Figures I and II.

The survey was organized under the direction of John F. McGuire, Acting Chief, Section of Standards and Surveys. J. C. Cook and R. D. Anderson, Staff Engineers, carried out the field work.

The laboratory analyses were done under the direction of R. E. Frazier, Chief, Section of Analytical Services of the Minnesota Department of Health. The laboratory procedures used in general are those outlined in "Standard Methods for the Examination of Water and Wastewater," APHA, AWWA, WPCF, 12th Edition.

DISCUSSION OF SURVEY

Lake Sampling

The lake water samples were collected with a fiberglass sampler of the Kemmerer type so as to avoid contamination of the sample by metallic ions originating from the usual metal sampler. The analysis for dissolved oxygen was done in the field by the azide modified Winkler method.

Weather conditions were clear and sunny throughout the survey but high winds caused cessation of sampling on two days which reduced the number of samples collected at the 100 foot depth from 24 to 7 and eliminated two sampling stations.

As can be seen from the summary of the data in Table 1, most of the values were extremely low, denoting waters of very high quality. The only high value found was for lead at Station LS-15 (approximately 15 miles southwest of the permit area). This value of 0.07 mg/l (milligrams per liter) is in excess of the standard of 0.05 mg/l for Class 1B waters (Lake Superior is classified 1B, 2A, 3A). There is no apparent explanation for this one isolated high value.

Other noteworthy individual values are those for total phosphorus and 5-day BOD (biochemical oxygen demand) for the samples from twenty feet of water at

Station LS-9 which was located one-quarter mile off the headland at Beaver Bay. These values (4.3 mg/l for 5-day BOD and 0.17 mg/l for total phosphorus) were much higher than those for the samples from the other stations and this might indicate that pollutional wastes were entering the lake with the flow of the Beaver River. This river discharges into the lake at a point just north of the headland and quite near the station (see Figure I). The five foot depth sample taken at this station had 1.7 mg/l and <0.01 mg/l of 5-day BOD and phosphorus, respectively. This would seem to indicate some stratification of the lake waters in this area which could be caused by the river flow.

A comparison of the data for the samples from inside the permit area with those from outside was made for all parameters. For most, a simple inspection of the data ranges, and means for the two sets of values (inside and outside) eliminated the likelihood of a significant difference (see Table 1). For those data for which the review indicated possible differences, further statistical analyses as described below were carried out.

It should be noted that it was decided not to test any data for the purpose of rejecting them, i.e., outliers, unless there was a strong reason to believe them to be wrong. Fortuitously, the parameters which were tested further were such as to indicate no need for testing for outliers and all data thus were used for the overall evaluation.

In analyzing the data for suspected differences between the samples from inside the permit area and those from outside, one is concerned with comparing the means of the samples for the purpose of determining if observed differences were due to chance only or related to the discharge of tailings. The most commonly used tests for comparing means are the normal distribution test and the Student's t test. The statistical tests used are described in detail in the references listed at the end of this report.

In the t test, which is a standard test for this type of analysis and is therefore used, it is assumed that the two sets of samples belong to the same population and the sample means are normally distributed about the population means, even if the distributions within the samples are not normal.

Before the t test can be applied, however, the assumption of homogeniety of variances must be tested. Since there were only two variances (inside permit area samples and outside permit area samples) a two-sided F test with a 95% confidence level was used for this analysis to test the hypothesis that the variance of the inside population is homogenous with the variance of the outside population.

Where the F test showed no significant difference, the standard t test was used with a pooled estimate of variance. Where the F test showed a significant difference, Cochran's approximation for t was used (see Snedecor, p. 97-99).

The statistical analyses were performed on six parameters. These six, shown in Table 2, are turbidity, total solids, total volatile matter, specific conductivity, organic nitrogen, and 5-day biochemical oxygen demand. By inspection, the remaining parameters were rejected for further analysis as having no significant differences between either the variances or the means.

Three of the tested parameters - turbidity, total solids, and total volatile matter - failed to show significant differences at the 95 percent level for either the variances or the means. That is, the means of the data for the samples from inside the permit area are not significantly different from those for the outside data.

The data for specific conductivity and organic nitrogen both had a significant difference in the variances of the inside and outside populations from which the samples were taken, but application of the approximated t test showed no significant difference between the respective means. That is, although the F test indicated a possible difference in the waters from which the samples for specific conductivity and organic nitrogen were taken, i.e., inside the permit area versus outside the permit area, the t test failed to show significant differences in the means. Therefore, we can statistically assume that the effluents were not significantly affecting the overall specific conductivity or organic nitrogen content of the water inside the permit area during the time of the survey.

It would also be possible to interpret the results of the statistical tests as indicating that all of the parameters both inside and out, except BOD, were being affected by the effluents because there were no significant differences between the water outside the permit area and that inside the area. However, the latter interpretation is dubious as is shown, for example, by a comparison of these data with the results of prior surveys by both the FWPCA and Reserve Mining Company, which yielded data presumably representative of the main body of the lake (see Table 4).

The analysis of the BOD data yielded some interesting results. As can be seen from Table 2, in this case both the F test and the t test proved significant at the 95 percent level. Unlike the case of the other parameters, there was a higher mean for the BOD data for samples from outside the permit area than for inside the area. This would seem to indicate that something other than the discharge of taconite tailings by Reserve was affecting the quality of the water in the area. Inspection of the data showed that all of the high BOD samples were taken southwest of the permit area below the mouths of the Beaver, Split Rock, and Gooseberry Rivers, from which it may be inferred that the rivers were the source of the higher BOD.

Comparison with Past Surveys

An attempt was made to compare the 1969 survey data with the data from surveys done previously for the Minnesota Water Pollution Control Commission. As can be seen from Table 3, the results were inconclusive. Many of the parameters analyzed for in 1969 were not done in the previous surveys. The few that were, except for turbidity, were done on a smaller scale rendering comparisons difficult. Having conducted the surveys at different times of the year and/or under different weather conditions, also compounds the difficulty of making comparisons, thus the data are presented in Table 3 for review purposes only, without any attempt to draw conclusions therefrom.

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MINNESOTA POLLUTION CONTROL AGENCY
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Lake Superior Survey
November 3-7, 1969

Table 1

Summary of Water Quality Data(a)

Parameter	All Samples			Inside Permit Area			Outside Permit Area		
	number:	range:	mean:	number:	range:	mean:	number:	range:	mean:
Turbidity Value	54	0.2-1.2	0.4	21	0.2-1.2	0.4	33	0.3-1.0	0.4
Total Solids(a)	43	50-70	59	20	58-70	61	23	50-64	58
Total Volatile Matter(b)	43	17-29	23	20	19-29	24	23	17-28	23
Suspended Solids	54	1-4	2.5	21	1-4	2.4	33	1-4	2.5
Suspended Volatile Matter	54	1-4	2.3	21	1-4	2.1	33	1-4	2.3
pH Value	54	7.5-8.0	7.6	21	7.5-8.0	7.6	33	7.4-7.9	7.6
Color Value	54	<1							
Dissolved Oxygen	54	12.0-14.3	12.7	20	12.3-12.4	12.6	34	12.0-14.3	12.8
Specific Conductivity (μmhos/cm^2)	54	66-160	93	21	82-160	101	33	66-100	90
Copper	54	<.01-.02	<.01*	21	<.01		33	<.01-.02	<.01*

Table 1 (Continued)

Summary of Water Quality Data(a)

Parameter	All Samples			Inside Permit Area			Outside Permit Area		
	number:	range:	mean:	number:	range:	mean:	number:	range:	mean:
Cadmium	54	<.01							
Zinc	54	<.01-.07	<.01*	21	<.01-.02	<.01*	33	<.01-.07	<.01*
Nickel	54	<.01							
Iron	54	<.02-.03	<.02*	21	<.02-.02	<.02*	33	<.02-.03	<.02*
Manganese	54	<.02-.03	<.02*	21	<.02-.02	<.02*	33	<.02-.03	<.02*
Lead	54	<.01-.07	<.01*	21	<.01		33	<.01-.07	<.01*
Silicate	54	2.0-2.8	2.3	21	2.0-2.5	2.3	33	2.1-2.8	2.3
5-day BOD	23	0.8-4.3	1.9	9	1.3-1.9	1.5	14	0.8-4.3	2.2
Total Phosphorus	45	<.01-.17	0.01*	18	<.01-.03	0.01*	27	<.01-.17	0.01*
Ammonia	18	<.05-.13	0.05*	8	<.05-.09	0.05*	10	<.05-.13	0.05*
Organic Nitrogen	18	.07-0.26	0.13	8	0.07-0.26	0.13	10	0.09-0.19	0.12
Nitrates	18	0.18-0.28	0.24	8	0.18-0.28	0.24	10	0.20-0.28	0.25
Nitrites	18	<.02-.02	<.02*	8	<.02	<.02	10	<.02-.02	.02*

(a) In milligrams per liter unless indicated otherwise.

(b) Total solids and total volatile matter samples were composited into 7 samples inside the area and 12 samples outside the area from the original 43. (see Table 7).

* Median value

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Table 2

Results of Tests for Significant
Differences Between Data from Within Reserve's
Permit Area and Data from Outside the Area

Parameter	$F^{(a)}$	$F^{(b)}_{.975}$	Significant	$t^{(a)}$	$t^{(b)}_{.05}$	Significant
Turbidity Value	1.46	2.31	no	by inspection		no
Total Solids	1.01	4.04	no	1.32	2.18	no
Total Volatile Matter	1.42	6.57	no	by inspection		no
Specific Conductivity (μmhos/cm^2)	3.72	2.51	yes	1.70	2.10	no
Organic Nitrogen	19.90	5.82	yes	1.04	2.45	no
5-day BOD	40.31	4.17	yes	2.50	2.17	yes

(a) Calculated values
(b) Tabular values

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Table 3

Comparison of 1969 Data With Data from Previous Surveys for the Minnesota Pollution Control Agency

Parameter	1969 No.	1969 range	1969 mean	1966 No.	1966 range	1966 mean	1955(b) No.	1955(b) range	1955(b) mean	1948, 1953, 1954(b) No.	1948, 1953, 1954(b) range	1948, 1953, 1954(b) mean
Turbidity Value	54	0.2-1.2	0.4	27	< 0.5-10	6.9	18	2.0-10	4.1	63	< 0.1-2.5	0.8
Total Solids (mg/l)	43(a)	50-70	59	12	50-79	61				19	52-93	65
Total Volatile Matter (mg/l)	43(a)	17-29	23	9	13-33	21				7	13-30	23
Total Phosphorus (mg/l)	45	< .01-.17	0.01*	14	< .01-.12	< 0.025*						
Manganese (mg/l)	54	< .02-.02	< .02*							9	< .02-.03	< .02*
Iron (mg/l)	54	< .02-.03	< .02*							19	.01-.08	0.13

(a) Composite samples (see Table 7)
(b) The taconite plant started production in 1956.
* Median values

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Table 4

Comparisons of 1969 Survey Means with Means for Data for "Open Water" Surveys

Parameter	Lake Superior near Silver Bay Nov. 3-7, 1969	FWPCA Stations[a]		Reserve Mining Co. Data[a]
		Lake Superior at Duluth	St. Mary's River at Sault Ste. Marie	
Dissolved Oxygen	12.7	12.6	12.2	13
Turbidity	0.4	0.3		0.4-0.5
Total Coliforms	<20*	3.68	5	
Ammonia	0.05*	.0024	.0348	<.01
Total Phosphorus	0.01*	.024		<.002
Iron	<.02*	.023		.008
Cadmium	<.01			<.001
Copper	<.01*	.003	.005	.003
Lead	<.01			<.001
Nickel	<.01			.005
Zinc	<.01*	.009	.041	.005
pH	7.6			7.6

(a) Data from *Proceedings, Conference in the Matter of Pollution of Lake Superior and Its Tributary Basin in the States of Minnesota, Wisconsin, and Michigan*, Duluth, Minnesota, September 30-October 1, 1969.

* Median values

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Analytical Data of Lake Superior from Stations in Permit Area

November 3-7, 1969

Table 5

Station	Description
A-1-5	Lake Superior about ½ mile from shore on NE boundary of permit area. Sample collected at 5 foot depth.
A-1-20	Same as A-1-5 except sample collected at 20 foot depth.
A-2-5	Lake Superior about 1 mile from shore on NE boundary of permit area. Sample collected at 5 foot depth.
A-2-20	Same as A-2-5 except sample collected at 20 foot depth.
A-2-100	Same as A-2-5 except sample collected at 100 foot depth.

	A-1-5	A-1-20	A-2-5	A-2-20	A-2-100
Date Collected	11/5/69	11/5/69	11/5/69	11/5/69	11/5/69
Time Collected	11:25	11:30	11:40	11:45	11:50
Temperature	42°				
Coliform group organisms { Con. MPN/100 ml	<20				
Coliform group organisms { Fecal MPN/100 ml	<20				
Suspended Solids	3	3	2	2	1
Suspended Volatile Matter	3	3	2	2	1
Turbidity	0.3	0.3	0.3	0.2	0.4
Color	<1	<1	<1	<1	<1
pH Value	7.8	7.5	7.5	8.0	7.7
Dissolved Oxygen	12.5	12.3			12.7
5-day BOD	1.3				1.4
Total Phosphorus	0.03	0.02	0.01		0.02
Ammonia Nitrogen	0.08				
Organic Nitrogen	0.14				
Nitrite Nitrogen	<.02				
Nitrate Nitrogen	0.18				
Copper	<.01	<.01	<.01	<.01	<.01
Cadmium	<.01	<.01	<.01	<.01	<.01
Nickel	<.01	<.01	<.01	<.01	<.01
Zinc	<.01	<.01	<.01	.01	<.01
Specific Conductivity µmhos/cm@25°C.	100	100	82	82	100
Iron	<.02	<.02	<.02	<.02	<.02
Manganese	<.02	<.02	<.02	<.02	<.02
Lead	<.01	<.01	<.01	<.01	<.01
Silicate	2.2	2.0	2.2	2.3	2.4

* Results are in milligrams per liter except as noted.

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Analytical Data of Lake Superior from Stations in Permit Area

November 3-7, 1969

Table 5 (Cont'd.)

Station	Description
A-4-5	Lake Superior approximately 200 yards off shore of tailing discharge. Sample collected at 5 foot depth.
A-4-20	Same as A-4-5 except sample collected at 20 foot depth.
A-5-5	Lake Superior about ¾ mile off shore of tailing discharge. Sample collected at 5 foot depth.
A-5-20	Same as A-5-5 except sample collected at 20 foot depth.
A-5-100	Same as A-5-5 except sample collected at 100 foot depth.

	A-4-5	A-4-20	A-5-5	A-5-20	A-5-100
Date Colledted	11/5/69	11/5/69	11/5/69	11/5/69	11/5/69
Time Collected	11:10	11:15	10:55	11:00	11:05
Temperature	42°				
Coliform group organisms Con. MPN/100 ml	< 20				
Coliform group organisms Fecal MPN/100 ml	< 20				
Suspended Solids	2	2	4	3	4
Suspended Volatile Matter	2	2	3	3	4
Turbidity	0.5	0.5	0.4	0.3	0.3
Color	< 1	< 1	< 1	< 1	< 1
pH Value	7.6	7.7	7.6	7.5	7.7
Dissolved Oxygen	13.4		13.0	12.8	12.5
5-day BOD	1.3				1.9
Total Phosphorus	0.03	< .01	0.03		0.81
Ammonia Nitrogen	< .05				0.09
Organic Nitrogen	0.26				0.19
Nitrite Nitrogen	< .02				< .02
Nitrate Nitrogen	0.22				0.26
Copper	< .01	< .01	< .01	< .01	< .01
Cadmium	< .01	< .01	< .01	< .01	< .01
Nickel	< .01	< .01	< .01	< .01	< .01
Zinc	< .01	.01	< .01	< .01	< .01
Specific Conductivity μmhos/cm@25°C.	160	83	98	92	98
Iron	< .02	< .02	< .02	< .02	< .02
Manganese	< .02	< .02	< .02	< .02	< .02
Lead	< .01	< .01	< .01	< .01	< .01
Silicate	2.3	2.4	2.1	2.3	2.4

* Results are in milligrams per liter except as noted.

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Analytical Data of Lake Superior for Stations in Permit Area

November 3-7, 1969

Table 5 (Cont'd.)

Station	Description
A-7-5	Lake Superior at corner of Reserve Permit Area about ½ mile off shore. Sample collected at 5 foot depth.
A-7-20	Same as A-7-5 except sample collected at 20 foot depth.
A-8-5	Lake Superior at SW boundary of Reserve Permit Area about ½ mile off shore. Sample collected at 5 foot depth.
A-8-20	Same as A-8-5 except sample collected at 20 foot depth.
A-8-100	Same as A-8-5 except sample collected at 100 foot depth.

	A-7-5	A-7-20	A-8-5	A-8-20	A-8-100
Date Collected	11/5/69	11/5/69	11/5/69	11/5/69	11/5/69
Time Collected	8:30	8:40	9:00	9:12	1300
Temperature					
Coliform group organisms Con. MPN/100 ml	< 20				
Coliform group organisms Fecal MPN/100 ml	< 20				
Suspended Solids	4	3	2	1	3
Suspended Volatile Matter	2	2	2	0.8	3
Turbidity	1.2	0.6	0.3	0.3	0.3
Color	<1	<1	<1	<1	<1
pH Value	7.5	7.6	7.6	7.6	7.7
Dissolved Oxygen	12.5	12.4	12.7	12.5	12.4
5-day BOD	1.3				1.6
Total Phosphorus	0.02	<.01			0.01
Ammonia Nitrogen	0.05				
Organic Nitrogen	0.13				
Nitrite Nitrogen	<.02				
Nitrate Nitrogen	0.22				
Copper	<.01	<.01	<.01	<.01	<.01
Cadmium	<.01	<.01	<.01	<.01	<.01
Nickel	<.01	<.01	<.01	<.01	<.01
Zinc	0.01	<.01	<.01	<.01	<.01
Specific Conductivity μmhos/cm@25°C.	98	98	83	83	98
Iron	<.02	<.02	<.02	<.02	<.02
Manganese	<.02	<.02	<.02	<.02	<.02
Lead	<.01	<.01	<.01	<.01	<.01
Silicate	2.4	2.5	2.2	2.2	2.4

* Results are in milligrams per liter except as noted.

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Analytical Data of Lake Superior from Stations in Permit Area

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Table 5 (Cont'd.)

Station	Description
LS-4-5	Lake Superior at east corner of Reserve Permit Area. Sample collected at 5 foot depth.
LS-4-20	Same as LS-4-5 except sample collected at 20 foot depth.
LS-6-5	Lake Superior at midpoint of outer boundary line of Reserve Permit Area. Sample collected at 5 foot depth.
LS-6-20	Same as LS-6-5 except sample collected at 5 foot depth.
LS-7-5	Lake Superior at south corner of Reserve Permit Area. Sample collected at 5 foot depth.
LS-7-20	Same as LS-7-5 except sample collected at 20 foot depth.

	LS-4-5	LS-4-20	LS-6-5	LS-6-20	LS-7-5	LS-7-20
Date Collected	11/4/69	11/4/69	11/5/69	11/5/69	11/5/69	11/5/69
Time Collected	11:07	11:15	10:40	10:45	9:30	9:35
Temperature °F	41°		41°			
Coliform						
group Con. MPN/100 ml	20		<20		<20	
organisms Fecal MPN/100 ml	<20		<20		<20	
Suspended Solids	1	4	1	2	2	2
Suspended Volatile Matter	1	2	1	2	2	2
Turbidity	0.6	0.5	0.4	0.4	0.5	0.4
Color	<1	<1	<1	<1	<1	<1
pH Value	7.5	7.7	7.6	7.7	7.6	7.6
Dissolved Oxygen	12.4	12.4	12.8	12.8	12.6	12.6
5-day BOD	1.8		1.4		1.3	
Total Phosphorus	0.02	0.02	0.01	<.01	<.01	<.01
Ammonia Nitrogen	0.05		0.13		0.07	<.05
Organic Nitrogen	0.09		0.16		0.07	0.10
Nitrite Nitrogen	<.02		<.02		<.02	<.02
Nitrate Nitrogen	0.28		0.25		0.26	0.22
Copper	<.01	<.01	<.01	<.01	<.01	<.01
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Nickel	<.01	<.01	<.01	<.01	<.01	<.01
Zinc	0.01	0.02	<.01	<.01	0.02	0.02
Specific Conductivity µmhos/cm@25°C.	99	98	98	97	100	98
Iron	<.02	<.02	<.02	<.02	<.02	<.02
Manganese	<.02	<.02	<.02	<.02	<.02	<.02
Lead	<.01	<.01	<.01	<.01	<.01	<.01
Silicate	2.3	2.1	2.5	2.4	2.5	2.4

* Results are in milligrams per liter except as noted.

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Analytical Data of Lake Superior

November 3-7, 1969

Table 6

Station	Description
LS-1-5	Lake Superior about 1 mile northeast of Reserve Mining's N. E. Permit Line and about ½ mile off shore. Sample collected at 5 foot depth.
LS-1-20	Same as LS-1-5 except samples collected at 20 foot depth.
LS-2-5	Lake Superior about 1 mile north of Reserve Mining's N. E. Permit Line and about 1 mile off shore. Sample collected at 5 foot depth.
LS-2-20	Same as LS-2-5 except sample collected at 20 foot depth.
LS-2-100	Same as LS-2-5 except sample collected at 100 foot depth.
LS-3-5	Lake Superior about 1 mile north of Reserve Mining's N. E. Permit Line and about 3 miles off shore. Sample collected at 5 foot depth.

	LS-1-5	LS-1-20	LS-2-5	LS-2-20	LS-2-100	LS-3-5
Date Collected	11/4/69	11/4/69	11/4/69	11/4/69	11/5/69	11/4/69
Time Collected	9:25	9:29	10:00	10:10	12:00	10:35
Temperature °F	41°		41°			
Coliform group organisms Con. MPN/100 ml	<20	<20				<20
Coliform group organisms Fecal MPN/100 ml	<20	<20				<20
Suspended Solids	4	3	3	2	3	2
Suspended Volatile Matter	3	3	3	2	3	2
Turbidity	0.7	0.5	0.5	0.9	0.4	1.0
Color	<1	<1	<1	<1	<1	<1
pH Value	7.5	7.5	7.7	7.9	7.7	7.5
Dissolved Oxygen	12.4	12.2	12.4	12.5	12.6	12.5
5-day BOD	1.0	0.8			1.7	1.0
Total Phosphorus	0.02	0.03	0.04		0.02	0.02
Ammonia Nitrogen	<.05				0.07	0.05
Organic Nitrogen	0.12				0.20	0.09
Nitrite Nitrogen	<.02				<.02	<.02
Nitrate Nitrogen	0.28				0.24	0.28
Copper	<.01	<.01	<.01	<.01	<.01	<.01
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Nickel	<.01	<.01	<.01	<.01	<.01	<.01
Zinc	0.01	0.01	0.02	0.01	<.01	0.01
Specific Conductivity µmhos/cm@25°C.	98	66	95	99	99	92
Iron	<.02	<.02	<.02	<.02	<.02	<.02
Manganese	<.02	<.02	<.02	<.02	.02	<.02
Lead	<.01	<.01	<.01	<.01	0.01	<.01
Silicate	2.1	2.1	2.1	2.1	2.8	2.2

* Results are in milligrams per liter except as noted.

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Analytical Data of Lake Superior

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Table 6 (Cont'd.)

Station	Description
LS-3-20	Same as LS-3-5 except sample collected at 20 foot depth.
LS-5-5	Lake Superior ½ mile S.E. of the east corner of Reserve Mining Area. Sample collected at 5 foot depth.
LS-5-20	Same as LS-5-5 except sample collected at 20 foot depth.
LS-7 (1)-5	Lake Superior ½ mile S.E. of midpoint of outer boundary line or Permit Area. Sample collected at 5 foot depth.
LS-7 (1)-20	Same as LS-7 (1)-5 except sample collected at 20 foot depth.
LS-8-5	Lake Superior ½ mile S.E. of the south corner of Reserve Permit Area. Sample collected at 5 foot depth.

	LS-3-20	LS-5-5	LS-5-20	LS-7(1)-5	LS-7(1)-20	LS-8-5
Date Collected	11/4/69	11/4/69	11/4/69	11/5/69	11/5/69	11/5/69
Time Collected	10:44	11:30	11:40	10:22	10:30	9:55
Temperature °F		41°				41°
Coliform group organisms Con. MPN/100 ml						
Coliform group organisms Fecal MPN/100 ml						
Suspended Solids	2	4		2	2	3
Suspended Volatile Matter	2	3		2	2	3
Turbidity	0.6	0.3		0.4	0.5	0.6
Color	<1	<1		<1	<1	<1
pH Value	7.7	7.7		7.5	7.5	7.5
Dissolved Oxygen	12.4	12.6	12.5	13.9	13.9	
5-day BOD						
Total Phosphorus	0.02	0.03		<.01		<.01
Ammonia Nitrogen						
Organic Nitrogen						
Nitrite Nitrogen						
Nitrate Nitrogen						
Copper	<.01	<.01		<.01	<.01	<.01
Cadmium	<.01	<.01		<.01	<.01	<.01
Nickel	<.01	<.01		<.01	<.01	<.01
Zinc	0.01	<.01		0.01	<.01	0.02
Specific Conductivity µmhos/cm@25°C.	98	99		82	80	81
Iron	<.02	<.02		<.02	<.02	<.02
Manganese	<.02	<.02		<.02	<.02	<.02
Lead	<.01	<.01		<.01	<.01	<.01
Silicate	2.2	2.4		2.4	2.4	2.3

* Results are in milligrams per liter except as noted.

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Table 6 (Cont'd.)

Station	Description
LS-8-20	Same as LS-8-5 except sample collected at 20 foot depth.
LS-9-5	Lake Superior 1 mile S.W. of west corner of Reserve Permit Area and ¼ mile off shore. Sample collected at 5 foot depth.
LS-9-20	Same as LS-9-5 except sample collected at 20 foot depth.
LS-10-5	Lake Superior 1 mile S.W. of west corner of Reserve Permit Area and ¼ mile off shore. Sample collected at 5 foot depth.
LS-10-20	Same as LS-10-5 except sample collected at 20 foot depth.
LS-10-100	Same as LS-10-5 except sample collected at 100 foot depth.

	LS-8-20	LS-9-5	LS-9-20	LS-10-5	LS-10-20	LS-10-1
Date Collected	11/5/69	11/5/69	11/5/69	11/5/69	11/5/69	11/5/69
Time Collected	10:05	1310	1320	1345	1355	1400
Temperature °F		42°		42°		
Coliform group organisms Con. MPN/100 ml		< 20				
Coliform group organisms Fecal MPN/100 ml		< 20				
Suspended Solids	2	2	3	2	2	2
Suspended Volatile Matter	2	2	2	2	2	2
Turbidity	0.3	0.6	0.5	0.4	0.3	0.3
Color	< 1	< 1	< 1	< 1	< 1	< 1
pH Value	7.5	7.4	7.5	7.6	7.6	7.3
Dissolved Oxygen		12.7	12.9	12.6	13.0	12.5
5-day BOD		1.7	4.3			1.3
Total Phosphorus		< .01	0.17	< .01		0.01
Ammonia Nitrogen		0.07				0.05
Organic Nitrogen		0.11				0.11
Nitrite Nitrogen		< .02				< .02
Nitrate Nitrogen		0.20				0.26
Copper	< .01	< .01	< .01	< .01	< .01	< .01
Cadmium	< .01	< .01	< .01	< .01	< .01	< .01
Nickel	< .01	< .01	< .01	< .01	< .01	< .01
Zinc	< .01	< .01	< .01	< .01	< .01	< .01
Specific Conductivity µmhos/cm@25°C.	31	98	82	98	99	100
Iron	< .02	< .02	< .02	< .02	< .02	< .02
Manganese	< .02	< .02	< .02	0.03	< .02	< .02
Lead	< .01	< .01	< .01	< .01	< .01	< .01
Silicate	2.3	2.5	2.4	2.3	2.2	2.4

* Results are in milligrams per liter except as noted.

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Analytical Data of Lake Superior

November 3-7, 1969

Table 6 (Cont'd.)

Station	Description
LS-11-5	Lake Superior 1 mile S.W. of Reserve Permit Area and about three miles off shore. Sample collection at 5 foot depth.
LS-11-20	Same as LS-11-5 except sample collected at 20 foot depth.
LS-12-5	Lake Superior 5 miles S.W. of Reserve Permit Area and about one mile off shore. Sample collected at 5 foot depth.
LS-12-20	Same as LS-12-5 except sample collected at 20 foot depth.
LS-12-100	Same as LS-12-5 except sample collected at 100 foot depth.
LS-13-5	Lake Superior 5 miles S.W. of Reserve Parmit Area and about 3 miles off shore. Sample collected at 5 foot depth.

	LS-11-5	LS-11-20	LS-12-5	LS-12-20	LS-12-100	LS-13-
Date Collected	11/5/69	11/5/69	11/5/69	11/5/69	11/5/69	11/5/69
Time Collected	1415	1425	1520	1530	1540	1455
Temperature °F						42°
Coliform						
group Con. MPN/100 ml	<20		<20			
organisms Fecal MPN/100 ml	<20		<20			
Suspended Solids	4	4	2	2	2	4
Suspended Volatile Matter	4	3	2	2	2	4
Turbidity	0.3	0.3	0.4	0.4	0.4	0.3
Color	<1	<1	<1	<1	<1	<1
pH Value	7.9	7.5	7.8	7.5	7.7	7.6
Dissolved Oxygen	14.3	14.3	12.7	12.7	12.4	12.8
5-day BOD	1.3		1.3		1.6	
Total Phosphorus	0.02	0.02	0.01	0.01	0.01	0.01
Ammonia Nitrogen	0.10		<.05		<.05	
Organic Nitrogen	0.10		0.13		0.12	
Nitrite Nitrogen	0.02		<.02		<.02	
Nitrate Nitrogen	0.23		0.28		0.22	
Copper	<.01	<.01	<.01	<.01	<.01	<.01
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Nickel	<.01	<.01	<.01	<.01	<.01	<.01
Zinc	<.01	0.01	<.01	<.01	<.01	<.01
Specific Conductivity µmhos/cm@25°C.	98	99	98	98	99	99
Iron	<.02	<.02	<.02	<.02	0.03	<.02
Manganese	<.02	<.01	<.02	<.02	<.02	<.02
Lead	<.01	<.01	<.01	<.01	<.01	0.01
Silicate	2.3	2.2	2.1	2.3	2.2	2.4

* Results are in milligrams per liter except as noted.

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Table 6 (Cont'd.)

Station	Description
LS-13-20	Same as LS-13-5 except sample collected at 20 foot depth.
LS-14-5	Lake Superior 10 miles S.W. of Reserve Permit Area and about 1 mile off shore. Sample collected at 5 foot depth.
LS-14-20	Same as LS-14-5 except sample collected at 20 foot depth.
LS-15-5	Lake Superior 15 miles S.W. of Reserve Permit Area and about 1 mile off shore. Sample collected at 5 foot depth.
LS-15-20	Same as LS-15-5 except sample collected at 20 foot depth.
LS-15-100	Same as LS-15-100 except sample collected at 100 foot depth.

	LS-13-20	LS-14-5	LS-14-20	LS-15-5	LS-15-20	LS-15-10
Date Collected	11/5/69	11/6/69	11/6/69	11/6/69	11/6/69	11/6/69
Time Collected	1502	10:00	10:15	12:00	12:06	12:15
Temperature °F		41°				
Coliform						
group Con. MPN/100 ml		<20		<20		
organism Fecal MPN/100 ml		<20		<20		
Suspended Solids	3	2	2	2	2	2
Suspended Volatile Matter	2	2	2	2	2	2
Turbidity	0.3	0.3	0.5	0.6	0.3	0.3
Color	<1	<1	<1	<1	<1	<1
pH Value	7.6	7.5	7.7	7.7	7.6	7.8
Dissolved Oxygen	13.7	12.2	12.6	12.3	12.4	12.1
5-day BOD		3.5		3.9		3.7
Total Phosphorus		0.02	<.01	<.01	<.01	<.01
Ammonia Nitrogen		<.05		<.05		
Organic Nitrogen		0.12		0.12		
Nitrite Nitrogen		<.02		<.02		
Nitrate Nitrogen		0.22		0.24		
Copper	<.01	0.02	<.01	0.02	<.01	0.01
Cadmium	<.01	<.01	<.01	<.01	<.01	<.01
Nickel	<.01	<.01	<.01	<.01	<.01	<.01
Zinc	<.01	0.07	0.02	0.02	0.03	0.02
Specific Conductivity µmhos/cm@35°C.	98	87	83	83	83	83
Iron	<.02	<.02	<.02	<.02	<.02	<.02
Manganese	<.02	<.02	<.02	<.02	<.02	<.02
Lead	<.01	<.01	<.01	0.07	<.01	<.01
Silicate	2.4	2.3	2.3	2.3	2.3	2.3

* Results are in milligrams per liter except as noted.

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Analytical Data of Lake Superior

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Table 6 (Cont'd.)

Station	Description
LS-18-5	Lake Superior 15 miles S.W. of Reserve Permit Area and about 1 mile off shore. Sample collected at 5 foot depth.
LS-18-20	Same as LS-18-5 except sample collected at 20 foot depth.
LS-19-5	Lake Superior 10 miles S.W. of Reserve Permit Area and about 3 miles off shore. Sample collected at 5 foot depth.
LS-19-20	Same as LS-19-5 except sample collected at 20 foot depth.

	LS-18-5	LS-18-20	LS-19-5	LS-19-20
Date Collected	11/6/69	11/6/69	11/6/69	11/6/69
Time Collected	11:30	11:40	10:45	10:50
Temperature °F	41°			
Coliform				
group { Con. MPN/100 ml				
organism { Fecal MPN/100 ml				
Suspended Solids	3	2	1	2
Suspended Volatile Matter	3	2	1	2
Turbidity	0.3	0.3	0.5	0.4
Color	<1	<1	<1	<1
pH Value	7.6	7.6	7.6	7.5
Dissolved Oxygen	12.0	12.7		12.4
5-day BOD			3.5	
Total Phosphorus	<.01	0.02	<.01	0.01
Copper	<.01	<.01	<.01	<.01
Cadmium	<.01	<.01	<.01	<.01
Nickel	<.01	<.01	<.01	<.01
Zinc	<.01	0.02	0.01	<.01
Specific Conductivity μmhos/cm@25°C.	81	81	82	83
Iron	<.02	<.02	<.02	<.02
Manganese	<.02	<.02	<.02	<.02
Lead	<.01	<.01	<.01	<.01
Silicate	2.4	2.3	2.4	2.3

* Results are in milligrams per liter except as noted.

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Table 7

Composite Samples for Total Solids and Total Volatile Matter of Samples Collected from Lake Superior

November 3-7, 1969

Composite #	Samples	Total Solids	Total Volatile Matter
#1	LS-1-5 LS-2-5 LS-3-5	59	28
#2	LS-2-20 LS-3-20	57	27
#3	A-4-5 A-5-5 LS-6-5	70	29
#4	LS-6-20 A-5-20	54	24
#5	LS-7(1)-5 LS-5-5	60	26
#6	A-1-20 A-2-20 LS-4-20	60	25
#7	A-7-5 A-8-5 LS-7-5	61	24
#8	A-7-20 LS-7-20 A-8-20	63	19
#9	LS-9-5 LS-10-5 LS-11-5	64	21
#10	LS-19-5 LS-13-5	64	21
#11	LS-9-20 LS-10-20 LS-11-20	60	19

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Table 7 (Cont'd.)

Composite Samples for Total Solids and Total Volatile Matter of Samples Collected from Lake Superior

November 3-7, 1969

Composite #	Samples	Total Solids	Total Volatile Matter
#12	LS-19-20 LS-13-20	60	25
#13	A-2-100 A-5-100 A-8-100	58	25
#14	LS-10-100 LS-12-100	58	23
#15	A-1-5 A-2-5 LS-4-5	59	24
Individual Samples	LS-12-5	60	26
	LS-12-20	54	17
	LS-2-100	52	17
	LS-7(1)-20	50	21

SKETCH MAP OF LAKE SUPERIOR SAMPLING STATIONS OUTSIDE OF THE RESERVE MINING PERMIT AREA

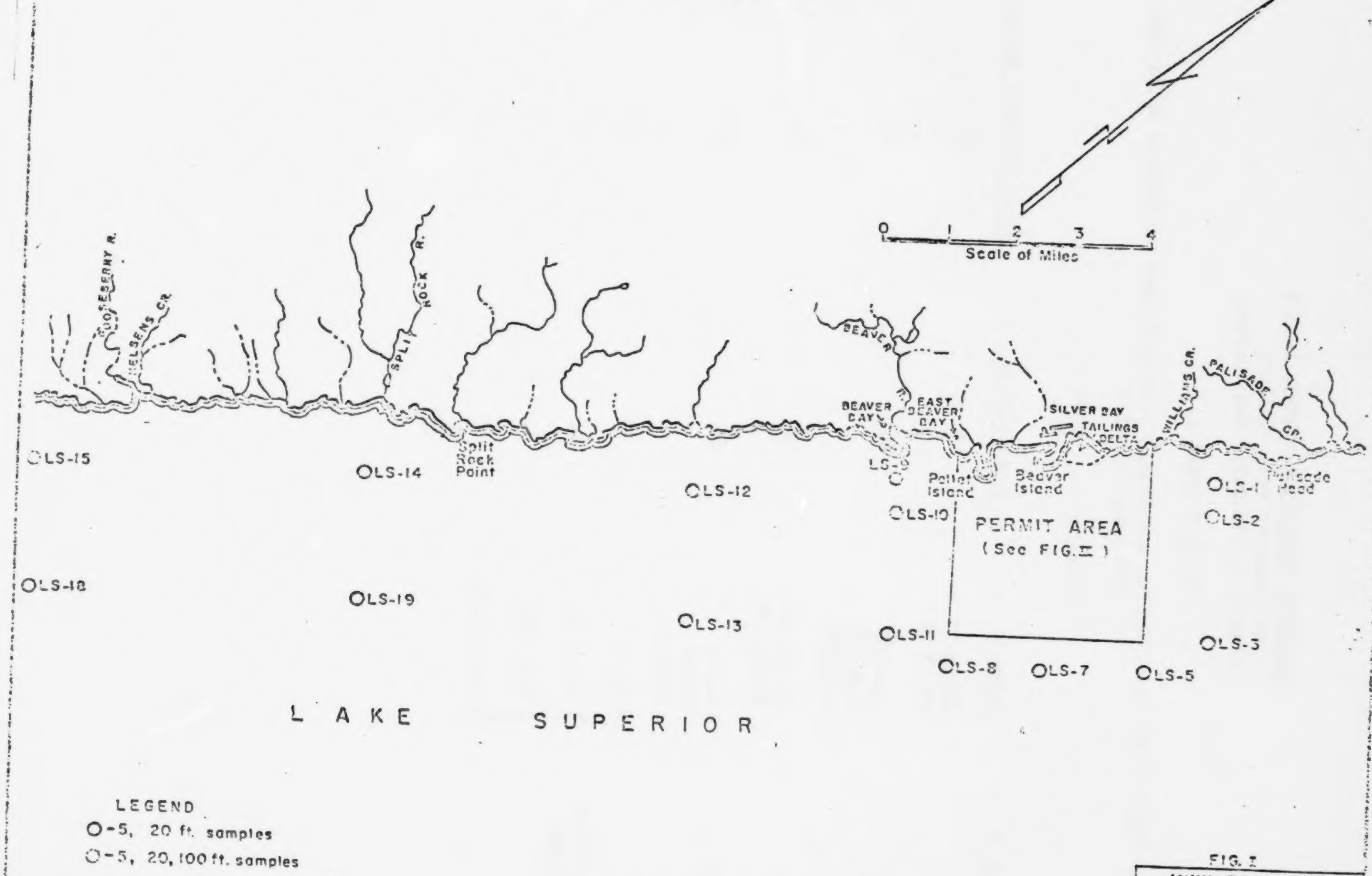
Scale of Miles
0
1
2
3
4
GOOSEBERRY R.
NELSENS CR.
SPLIT ROCK R.
Split Rock Point
BEAVER R.
BEAVER BAY
EAST BEAVER BAY
Pellet Island
Beaver Island
SILVER BAY
TAILINGS DELTA
WILLIAMS CR.
PALISADE CR.
Palisade Head
PERMIT AREA
(See FIG. II)
OLS-15
OLS-14
OLS-12
LS-9
OLS-10
OLS-1
OLS-2
OLS-18
OLS-19
OLS-13
OLS-11
OLS-3
OLS-8
OLS-7
OLS-5
LAKE SUPERIOR
LEGEND
O-5, 20 ft. samples
O-5, 20, 100 ft. samples

FIG. I

MINN. POLLUTION
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NOV. 1969

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SKETCH MAP OF LAKE SUPERIOR IN VICINITY OF SILVER BAY

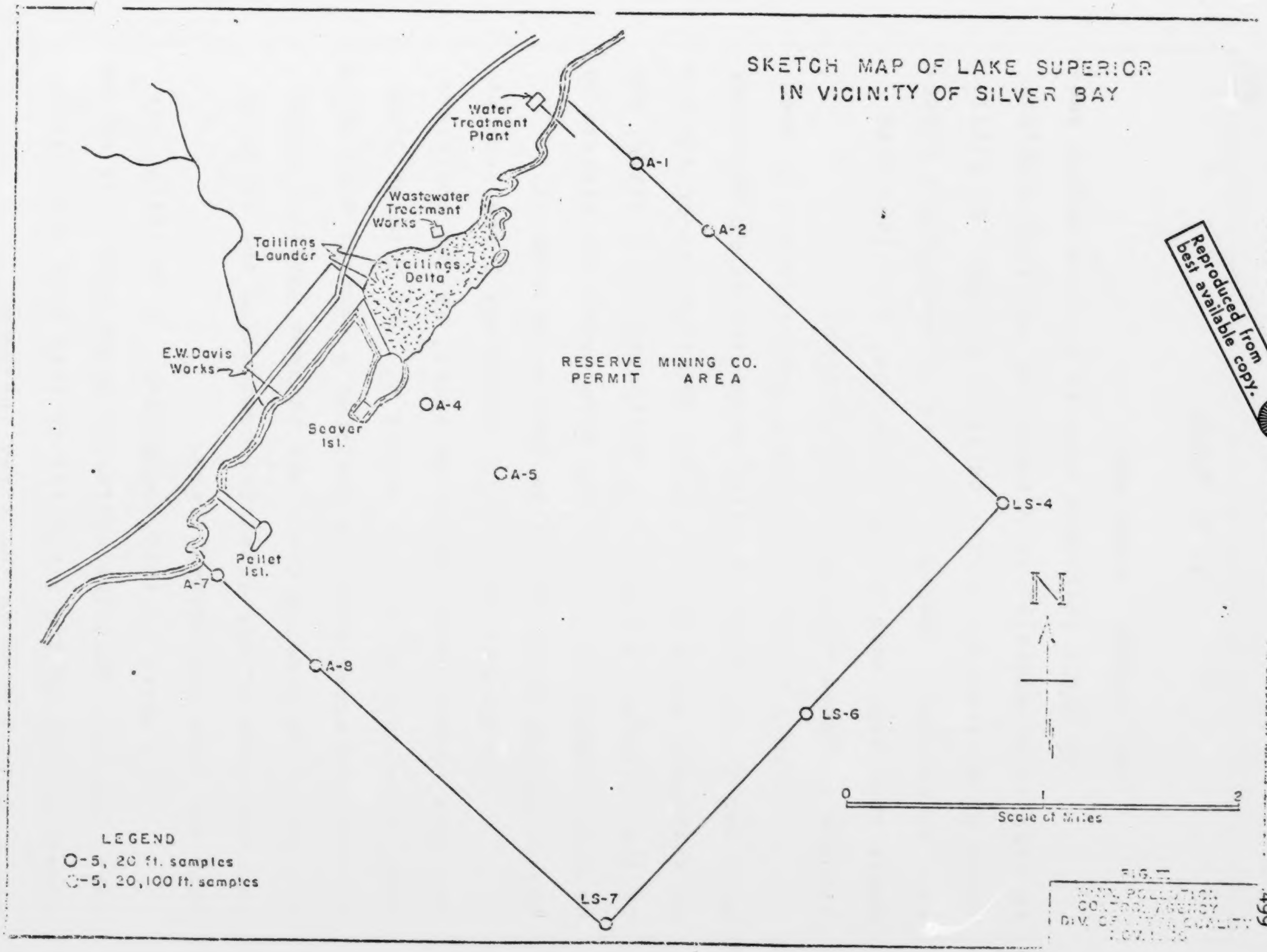
Water Treatment Plant
A-1
A-2
Wastewater Treatment Works
Tailings Launder
Tailings Delta
E.W. Davis Works
A-4
Beaver Isl.
RESERVE MINING CO. PERMIT AREA
A-5
LS-4
Pellet Isl.
A-7
A-8
N
LS-6
0
1
2
Scale of Miles
LS-7
LEGEND
○-5, 20 ft. samples
○-5, 20,100 ft. samples

FIG. II

MINN. POLLUTION
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DIV. OF WATER QUALITY
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MR. FRIDE: Thank you.

Up until yesterday Reserve's presentation was to consist essentially of a report on possible modifications or alterations of the tailings system. We still plan to do that. However, in view of yesterday's statements that were made to the conferees, I believe that balance dictates some additional comment.

When I conclude, I will introduce Dr. G. Fred Lee, who is Professor of Water Chemistry at the University of Wisconsin and a member of the President's--or adviser of the President's Council on Environmental Quality, and he will comment on some of the more technical aspects of the situation as it exists to date as he sees it.

I thought for awhile yesterday I was back at the Lake County Court, where we spent, as the conferees know, from June 22 through August 5. And I think I am inclined to agree with the Chairman's comment that while litigation is pending there may be some question about the propriety of any extensive comment on the evidence that has been introduced there.

I agree in that connection. I do think, perhaps, however, that the conferees might have some better understanding of the situation if they knew why there was a court action in the first instance.

Going back to the presentation that was made last May of 1969, you will recall that evidence was introduced at that time that the premise upon which the permits were applied for involved the utilization of a heavy density current which would form when the taconite tailings in the effluent would reach Lake Superior. This heavy density current has as its function the efficient transportation of the tailings to the deep trough adjacent to Silver Bay out in Lake Superior. Now, that was the premise upon which the application was made; it was the premise upon which the permits were granted, and also, of course, the premise upon which the plant was constructed and some $350 million were invested. Obviously, in general terms, the more dense the effluent the more efficient the heavy density current, and in connection with Reserve Mining Company it was then contemplated, and has proven out through experience, that the effluent would have a density of about 14,000 milligrams per liter of the suspended solid material known as taconite tailings.

This was the situation since 1956, and, of course, the plant operated from that time and is, of course, operating now.

But in 1969, on November 26 of 1969, the Secretary of the Interior approved the Minnesota regulation known as WPC 15, which contained in it an effluent limitation of 30 milligrams per liter of suspended solids and a turbidity limitation of 25. This flew right in the face, of course, of the entire operation of the plant, the system of tailings disposal, and the basis upon which the plant was constructed and was operated. With a 30 milligram per liter limitation, even if one diluted the effluent to meet that kind of a limitation, the result would be an unsound conservation practice because obviously the tailings would be spread throughout the lake and over the surface of the lake rather than being transported by the heavy density current to the deep trough.

Because of that particular adoption of that regulation and because there is in Minnesota a statute which says in effect that if you do not take an appeal from a regulation of the agency to the District Court, you then lose any opportunity to challenge the reasonableness or validity of that regulation in any subsequent proceeding, and so under the timetable established by the statute, Reserve had to take an appeal within 30 days from the time the Secretary acted, and in fact it did so. That is why the matter is in the court litigation.

The Minnesota Supreme Court has approved the principle that a particular discharger may take an appeal, which is really a singular appeal, from the regulation. In other words, Reserve challenged the validity and reasonableness of the regulation as applied to Reserve Mining only, and it has no influence on its possible application to any other discharger in the State.

When that appeal was taken the State counterclaimed, the State Pollution Control Agency counterclaimed. They in effect requested the District Court to enforce the regulation and they also claimed that Reserve's discharge was violating the Minnesota pollution statutes, which, incidentally, are quite strict, and properly so, I might add.

That, then, brought the matter into court, and I think that it probably is very clear that if there is not intrastate pollution within the meaning of the strict Minnesota statutes, I suggest there can hardly be any interstate pollution. In any event, the court now has that matter under advisement, the briefs in the case are due on September 5, and we are hopeful that a prompt decision will be reached.

I can agree with Mr. Friedell that he and the senior counsel, Mr. Jerome Truhn, who represent the Minnesota Pollution Control Agency, presented a very vigorous case. I can agree, certainly, with the Chairman that, among others, there were 11 of the top specialists in the Interior Department who testified. I think it is fair to note also that Reserve called some 15 witnesses, including some witnesses who are internationally and nationally known in their particular fields.

I don't think it would be appropriate for me to comment further on what I think the evidence demonstrated. But I do think that the conferees may very well wish to give some consideration to the trial court's decision when he issues it, because, after all, he has listened to almost seven weeks of testimony, has reviewed almost 300 exhibits, and I think would have a pretty good grasp of the entire situation.

It also, of course, represented the first opportunity that Reserve has had since this controversy became current to cross examine witnesses, to introduce fully testimony by witnesses, to scrutinize exhibits, and to investigate the supporting data or lack of data behind conclusions that might otherwise be made.

Something over a year has passed since the conference first convened. I think it might be appropriate to take just a few minutes and reflect on perhaps what contributed to have the conference called in the first place and where we have gone since the first session convened. I think that it might be appropriate to submit a couple of quotations to you that you may wish to give some consideration to.

In 1967 Dr. Louis Williams, who was then associated with the National Water Quality Laboratory, wrote a paper which he had published in a magazine called Bioscience. He sent copies of that article widely throughout the United States. He sent it to political leaders; he sent it to the Governors of our adjoining States. It accused Reserve Mining Company of having a harmful effect on Lake Superior by the discharge of its tailings. Necessarily people, government officials and others who received that communication, became interested in the problem and curious about it.

Unfortunately, the problem, or at least the article, the statements made about it, received somewhat more currency than did the response, for example, that Dr. Mount made at the time in response to an inquiry from the Wisconsin Department of Natural Resources. In a letter that he wrote dated October 18, 1967, Dr. Mount said, and I quote:

> "In regard to your inquiry concerning the Williams' report, I am sorry to say that we do not have or know about the data to which he refers. We are writing to him requesting the data that he refers to in his report, but we do not expect to receive it because to our knowledge he has none. He addressed this report in memo form to me and Dr. Tarzwell before leaving Duluth, and we were not aware that copies were sent to others until we heard about it through the news media.
>
> "I feel that it is an irresponsible report based, insofar as we know, on 'bank-side' observations and is embellished with general speculation. I have tried to locate the data to which he refers to no avail and I have discussed the problem with several co-workers."

Subsequently, in 1968, the so-called Stoddard investigation was made. In December of 1968 it was released. It apparently was the basis, or at least a substantial basis, upon which Secretary Udall on January 6, 1969, issued his call for this conference.

I think it is perhaps well to recall that the so-called Stoddard report has been disowned in many quarters, including at the convening of this conference when Assistant Secretary of the Interior Klein disowned it. I think it is also important to recognize that, for example, Secretary Udall, then former Secretary Udall, on June 11, 1969, disowned it in the Congressional Record and Commissioner Dominick of the Interior Department, by a letter dated November 25 of 1969, stated in part:

> "...I would like to stress, however, that... (the so-called 'Stoddard report') was not released as an official Department of the Interior publication because of technical questions and because the report was superseded by the Lake Superior Enforcement Conference which made a more authoritative review of the matter..."

He goes on to say that prior to full evaluation by the agencies involved, Mr. Charles Stoddard, then Interior Regional Coordinator in the area, sent a copy of the summary report to the Corps of Engineers. At the same time, the Federal Water Pollution Control Administration was following up its earlier studies in preparing for a comprehensive conference of the water quality problems of Lake Superior that would cover Reserve Mining Company among other dischargers.

Thus the so-called Stoddard report was sent to the Corps without first having been evaluated technically by the Federal Water Pollution Control Administration scientists in Washington. When the summary was reviewed by the technical staff of this agency, there was concern that certain findings and recommendations might not be fully supported in all respects by a critical scrutiny of the data accumulated by the field personnel.

So that we have, I submit, at least some question as to whether the very report which was the premise for the calling of the conference in fact actually represented any official view of the Department of the Interior.

Be that as it may, the conference was convened, and I think again it is interesting to note that many of the charges which had previously been made were not repeated in the official publication of the material, which was entitled, "An Appraisal of Water Pollution Problems in the Lake Superior Basin," and was dated April of 1969.

For example, the 1968 report concluded that lead and copper levels in the vicinity of Silver Bay exceeded water quality standards and that aluminum, lead, copper, zinc, cadmium, and nickel were also found to be in concentrations in excess of commonly accepted levels for supporting aquatic life, end of quote. The official report stated with respect to the trace metals:

> "There are small amounts of trace metals which are bound into the material which forms taconite tailings."

The official report said:

> "The chemical state of these metals was not assessed and it would be presumptuous to say at this time what portions of the elements enter into solution."

The official appraisal report, however, relied exclusively on the report on the Minnesota Agency's study. You will recall, there was a joint study by the Minnesota Pollution Control Agency and the Minnesota

Department of Conservation with respect to bottom fauna, and that bottom fauna study was utilized as a reference in the official report and is the only basis cited in the report for the conclusion that, "The discharge of taconite tailings to Lake Superior from the Reserve Mining Company has a deleterious effect on the ecology of a portion of the lake by reducing organisms necessary to support fish life."

When one examines, however, the State report to really try to determine whether it supports the conclusion of a deleterious effect, it is significant to note that the report itself refers only to the possible decline in pontoporeia, which is a bottom scud, which is principally the fish food for smelt, and I submit that we don't really have a great deal of shortage of smelt in Lake Superior.

And the report itself indicated, and I quote, "it should be emphasized that the foregoing calculations are not exact, but they do indicate that the effect of the tailings on fish production within the area where tailings are deposited is small and that the bulk of the fish food in the area is of free-swimming organisms and not of bottom fauna that may be affected by tailings deposition."

I think the conferees will recall that when Mr. Rygg, the Assistant Commissioner of Conservation for the State of Minnesota, presented a statement on the official position of the Minnesota Conservation Department to the conferees in May of 1969 he said, and I quote, "Our studies of the record and of the lake indicate that present taconite operations are not currently having an appreciable effect on fish production in the lake."

Now, there were some extensive studies, I believe, conducted by the Federal Water Quality Administration and by the National Water Quality Laboratory. Those studies and the conclusions which they reached from those studies were presented to the conferees at the May 13 through 15, 1969, session. I think again it is interesting to note that after that conference, and pending an executive session of the conference which was called for the purpose of permitting the conferees to review what had already been presented at the May 13-15 session, that the National Water Quality Laboratory then engaged in another extensive study on Lake Superior which started, I believe, on May 27 in 1969, shortly after the first session of the conference was concluded. In memorandums which are dated May 28, 1969, the National Water Quality Laboratory estimated the costs of those studies, which were directed solely and exclusively to a consideration of Reserve Mining Company's taconite tailings on Lake Superior. The estimates of the cost of them and the number of men involved was estimated variously from $200,000 to $400,000, with a possible increase to $800,000. Additional studies were in fact undertaken.

Subsequently, on September 8 of 1969, Dr. Mount, in summarizing a September 4, 1969, conversation with Assistant Secretary Klein, stated, and I quote: "We then briefly discussed the problem of establishing adverse effect on the health and welfare of people in Wisconsin, and I indicated that none of our studies, either completed or planned, would really provide evidence of damage in the lake itself."

At the September 30-October 1, 1969, reconvening of this conference, the Executive Session of the conference, the conferees were then presented with additional information by the Water Laboratory and a tentative or presumptive conclusion was then reached by the conferees that there was evidence of danger to the health or welfare of persons in States other than Minnesota.

Subsequent to that, on December 5, 1969, in a memorandum prepared for the Assistant Secretary of the Interior, Dr. Mount stated, and I quote:

> "...There is no data to suggest damage to water quality or aquatic life in Wisconsin waters. There is very doubtful evidence of material damage to aquatic life in Minnesota waters. The solution rate of the tailings is extremely slow. The actual rate has not been measured. The effect of natural flocculents on the flocculation of tailings has been ignored. The basic problem: Some percentage of the fine material less than a few microns in diameter does not settle in front of the plant but is transported for considerable distances in the lake before being deposited on the bottom.... Public reactions: The discharge is big and turbid and looks bad...There have been drastic changes in the fish populations of the lake due to factors unrelated to taconite. This has sensitized the public and made them search for a cause..."

Dr. Mount went on to discuss the various alternative disposal methods. He considered advantages and disadvantages of various alternates to the present method of tailings handling. He considered the discharging of the effluent to a stilling basin. He listed the advantages: That all water could be recycled so that none returns to the lake except through ground seepage; second, that the visible discharge would be eliminated. Disadvantages: One of the most costly methods of disposal. The stilling basin would destroy natural lakes and wildlife habitat and inundate private cottages; would require construction of a generating plant. The basin would receive natural runoff that would have to be disposed of in some manner.

The second one he considered was piping effluent to the lake bottom. He said as far as advantages, probably one of the cheaper methods; the discharge would be less visible to the public. Disadvantages: Would not keep lake currents from transporting the fine particles, suspended in a huge volume of water, over other parts of the lake.

The third one he considered was coagulation. Said advantages: Would allow the continued discharge into the lake with minimal alterations and plant processes. The disadvantages: The discharge would still be visible to the public. Unknowns: Cost. Secondly, would require the use of other chemicals, such as coagulants.

The next one he considered was hauling the solids back to the mine at Babbitt. Advantage: Would minimize damage to the terrestrial areas and remove solids from the lake. Secondly, disadvantages: Impractical, because the fine materials are suspended in a huge volume of water and would have to be removed and dried (because of cold winter temperatures) before being loaded on cars to be hauled back to the mine. Dry tailings are very dusty.

He went on to consider violation of existing permits. His opinion:

a) The Corps of Engineers permit--no violation.

b) The Minnesota Pollution Control Agency permit. The intent is probably violated, he thought, by the presence of green water outside the three-mile limit. Secondly, the letter of the permit is probably not violated in any way because it would appear to be difficult, if not impossible, to define such terms as material discoloration.

He went on to say, "There is weak evidence to support a very minimal effect on the lake itself in the near vicinity of the discharge."

Subsequently additional studies were made and a report was presented at the April 29-30, 1970, session of the conference. I don't know, at least as I heard Dr. Mount yesterday, that he reported on any additional studies that the laboratory had made other than those which he did report at the April session. I think he did make some comment about Dr. Shapiro's study, but that, of course, was not performed by the water laboratory.

He presented at that session certain technical reports as well as a summary of what he considered were the important considerations relating to Reserve's discharge as of that time. In so doing, it was clear that many of the charges which were previously made against Reserve by various sources were either abandoned or found wanting in supporting evidence. He noted that green water masses along the Wisconsin shore did not contain tailings, and thus, obviously, Reserve's discharge did not cause or contribute to such occurrences.

He emphasized that the discharge of tailings did not have any adverse effect on public water supplies. He commented that, "One can see that the tailings are being deposited primarily in the deep trough off the Minnesota shore and that on this transect no tailings were found in the Wisconsin portions of the lake."

He said that tailings particles of greater than 2 microns size would not be expected to be transported any substantial distance in the lake and that direct toxic effects on fish and fish food organisms were not expected to occur at realistic concentrations of the tailings to be found in the lake, except possibly for local areas near the discharge and in the heavy density current.

He also reported that at a 10 percent tailings effluent there was slight algal growth promotion. It is suggested that that concentration is not realistic insofar as the lake is concerned.

In commenting on the bacterial studies, he said, "There is no implication from this data that we should expect to see a bacterial problem in Lake Superior if discharges containing bacteria are adequately controlled."

In concluding he noted, "In my judgment, the effect of Reserve's discharge should be assessed in terms of altering the lake's appearance rather than the toxic effects on fish and fish food organisms, or endangering water supplies."

After the statement was made, there were some questions that were posed to Dr. Mount by the conferees. In response to one of them he said, "Mr. Frangos, I would like to point out again, I think it is very important that the algal growth studies which we have reported are only a small number of experiments and I don't think we should make world-shaking conclusions on that amount of data." No further studies have been reported by that laboratory since that statement.

In responding to another conferee's inquiry with respect--to the same conferee's inquiry with respect to stimulation of bacteria, Dr. Mount had Dr. Glass of his staff answer an inquiry about bacteria stimulation from tailings as contrasted with any stimulation from natural sediments. Mr. Frangos said, "Fine, but there may be other materials that similarly stimulate this kind of growth.

"DR. GLASS: Of course* You might derive the same thing from the sediments.

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*Exact quote is: "Oh, certainly."

"DR. MOUNT: I think it is a very significant point, that we are not dealing with an isolated effect. I believe that is very important."

In assessing laboratory experiments which have been reported to the conferees, it seems obvious and important that care must be taken in translating their results to Lake Superior.

It is suggested that with respect to the bacterial investigations reported that the most likely source of food for the organisms was in the growth medium that was transferred to the tailings solution by the bacterial inoculant. This comment is reinforced by the fact that there was substantial bacterial growth occurring in the control which did not contain tailings. In addition, the amount of growth attained was not at all proportional to the amount of tailings added.

It is submitted that a realistic appraisal of all the evidence indicates that there is no showing of any change in water quality of Lake Superior associated with algal or bacterial growth which has any relationship to the tailings from Reserve Mining Company's plant.

In the Conference Summary that was issued by the Secretary of the Interior on January 26 of 1970 it was stated:

> "There is presumptive evidence in the record to indicate that the discharges from the Reserve Mining Company endanger the health or welfare of persons in States other than that in which such discharges originate," and so forth.

In utilizing the term "presumptive," it might be well to go back to the record that this conference made at the September 30-October 1 session, in which Mr. Purdy said, and I quote:

> "What I mean by presumptive evidence is that, as I understand it, these will be continuing, there will be continuing analytical work on samples already collected, and that this may at some later point in time--or that this at some later point in time should be reviewed by the conferees to make a determination whether there is such a pollution occurring or whether there is not such a pollution occurring."

It is submitted that a realistic appraisal of the record does not support any claim that Reserve's discharge endangers the health or welfare of persons in

States other than that in which the discharge originates, which is, of course, the basis upon which this conference is called.

On April 17 of 1970 Dr. Mount stated, "I am doing everything within my power to extract ourselves from further work on Lake Superior, because I feel we have much more pressing problems in other places in the country, such as New Orleans, the Columbia River, and similar situations."

On May 11 of 1970 Mr. John Teasley, with the approval of Dr. Mount, stated:

> "The National Water Quality Laboratory is not working on the pollution of Lake Superior. The waters of Lake Superior are not polluted. This is one of the finest bodies of water in the world today. The water samples we are analyzing from Lake Superior are not to determine pollution, but to give our biologists a chemical and bacteriological baseline to use in their bioassay explorations. These samples have not shown Lake Superior to be polluted."

In June of this year Dr. Mount stated in response to questions:

"QUESTION: You probably already covered this, but to your knowledge"--in June of '70--"based upon the studies that have been made and the investigations, you have no evidence of any adverse effect on the water quality or the health or welfare of persons in States other than Minnesota, do you?

"ANSWER: In terms of measured effect, adverse effect on organisms in Wisconsin or Michigan, there has been little effort to do it, but we have no information that any kind of eggs, fish, or benthic organisms have been adversely affected directly by the tailings deposition over there. This is not to say that there are--well, let me put it a different way. I believe that there are changes, although most probably not measurable by present techniques, in the waters of Wisconsin."

Further, in response to a question:

"QUESTION: You do not regard, on the basis of all the information that is available to you, that Reserve's taconite discharge constitutes any danger to the public water supplies?

"ANSWER: The present evidence suggests that there is no danger existing at the present time."

Further:

"QUESTION: You don't regard that bacteria is of any great significance in terms of any potential danger to the public water supplies of Lake Superior, do you?

"ANSWER: That's right."

"QUESTION: Based upon information available to you, Dr. Mount, you do not have any reliable evidence, do you, that the taconite tailings cause contamination of Lake Superior so as to be actually harmful to public health?

"ANSWER: Beyond the immediate area of the discharge I know of no data which conclusively shows that taconite tailings have caused concentrations of materials in the water that exceed the recommended limits as outlined in the National Technical Advisory Committee report.

"QUESTION: Certainly any bacteria that is present in Lake Superior, at least in general terms, does not represent any public health hazard, does it?

"ANSWER: The present population of bacteria in the lake, so far as we know, with the possible exception of local areas such as the St. Louis River mouth, do not."

Now, since the reports that were made by Reserve Mining Company in May of 1969, which then summarized the current information available, and consistent with the conferees' recommendations that reports be submitted on a monthly basis to the Minnesota Pollution Control Agency, Reserve has submitted monthly reports to the Minnesota Agency, and while I don't have them available today for all the conferees, I would like, Mr. Stein, to submit for the record the various reports which have been made up to date to the Minnesota Pollution Control Agency.

MR. STEIN: Do you want those as exhibits?

MR. FRIDE: Yes, I would like them as exhibits, if I could, Mr. Chairman.

MR. STEIN: Yes, they will be included as exhibits, without objection.

MR. FRIDE: Thank you.

(The reports referred to are marked Exhibit 3 and are on file at the FWQA Headquarters in Washington, D.C., with a copy on file at the FWQA Regional Office in Chicago, Illinois.)

MR. FRIDE: Reserve has submitted considerable data during the 1969 sampling season, most of which was not presented to the conference, and this is summarized in those various reports. I think that there is considerable information that the conferees may want to give consideration to.

Yesterday a couple of questions were raised in which the Chairman indicated some interest in response. One related to calcium chloride and the other related to sulfuric acid. In common with anybody else that operates a boiler in industry in Minnesota and elsewhere, it is necessary, in connection with the water softening process in the boilers, to add or utilize some acid. In the process, however, that acid at Reserve is neutralized by sodium hydroxide and when it goes to the lake it is sodium sulfate, which is simply a harmless salt.

Insofar as calcium chloride is concerned, back in 1955 when the operation commenced it became quite obvious that during the winter months the ore from Babbitt would freeze and would not be subject to the proper processes in the operation, with the result then and since that with the knowledge and acquiescence of the Minnesota Pollution Control Agency and with the knowledge of the Corps of Engineers and the Department of Conservation, the three sources of Reserve's permit, calcium chloride was added and has been added to the ore at Babbitt in connection with the winter months. I might say that it is the same calcium chloride that is utilized on the streets of municipalities and highways during winter months, which, of course, also flows, generally speaking, into the lake, depending upon its particular location, but that it, too, is a harmless material insofar as the lake is concerned, and that so far as Reserve is concerned, when it does utilize the calcium chloride there is added one pound for every 12,500 gallons.

In connection with the reports to the Pollution Control Agency which have been received as an exhibit, I would think that we might want to draw some attention to the fact that calcium chloride is reviewed in there, as it has been in earlier reports, and also that there is a reflection in those reports of the efforts made by Reserve to determine what, if any, long-range effect its discharge may have on Lake Superior. Reserve has used a mathematical model to calculate the effect of in-plant use of water on the chemistry of Lake Superior. It is reported on page 13 of the April 1970 report.

Several conditions were calculated. The most severe consideration shows that even after a hypothetical 50 or 100 years of Reserve's discharge, having in mind that the present plan is for 40 additional years, there would not be a detectable increase in the amount of dissolved solids by today's most sophisticated methods of analysis. Similar results are shown for calcium, magnesium, iron and manganese. These results include the effect of calcium chloride and all other changes in these elements by Reserve's use of Lake Superior.

The mathematical model is supported by the fact that after 15 years of Reserve's operation there has not been any change in the dissolved solids in Lake Superior water.

I submit that that has some significance, because as one listened to the various speakers yesterday, one might conclude that they were trying to assess a new operation and to try to estimate what, if any, effect it might have on the lake. Actually, I think the conferees should give proper credence and weight to the fact that there has been operation for some 15 years; it just hasn't started, and the effect of the deposition of taconite tailings on Lake Superior in 15 years, there has been no evidence to show any harmful effect on any beneficial use of the lake.

After all, if some of the hypotheses that have been postulated have any accuracy, one would expect to find a change in turbidity in Lake Superior; one would expect to find an increase in suspended solids in Lake Superior. The fact of the matter is that independent sources who have verified this subject, the Duluth water plant, the Silver Bay water plant--and I would like to introduce for the record copies of their reports both prior to and since the company's operation--reflect no change in turbidity and no change in any beneficial use of the lake as that has been monitored in certain parameters by those agencies.

(The reports referred to are marked Exhibit 4 and are on file at the FWQA Headquarters in Washington, D.C., with copies on file at the FWQA Regional Office in Chicago, Illinois.)

MR. FRIDE: Yesterday Dr. Berryman submitted certain figures to the conference, apparently relating to the subject of economics. I think it is interesting to note that after Reserve afforded to Dr. Berryman full access to Reserve's books and records that he found no dispute with any of the accuracy of the figures quoted by Reserve Mining Company.

I think it ought to be clear, too, as far as the record is concerned, that Reserve Mining Company is a Minnesota corporation. In common with many other iron mining companies in Minnesota and many mineral companies elsewhere in the country, it is a so-called cost company, but Reserve is a Minnesota corporation, has two shareholders. We stated this at the outset of this conference that Republic and Armco each own 50 percent, but it doesn't follow from that that the overriding considerations of supply and demand have in any way been changed or eliminated by the fact that Reserve is a cost company.

I don't want to dwell too much on this because I think that actually the basic difference between anything that Dr. Berryman said insofar as his comments are concerned, he came up with a figure of $2.19 a ton profit; Reserve's figures show $1.58 a ton profit. I don't suspect that either one of those numbers reflects any overwhelming profit insofar as the operation is concerned.

The difference, however, is very simple. Mr. Berryman in computing his figure did not take into consideration what you have to take into consideration in terms of making any kind of analysis of that sort and that is normal capital replacements. In Reserve's case the normal capital replacements on an annual basis amount to $4.5 to $5 million a year. If you include that figure in Mr. Berryman's thesis, you come quite close to the profit figure referred to by Reserve.

Similarly Reserve calculated, as he reported, a rate of return of investment of 4.41 percent. Mr. Berryman calculated 7 percent. Again, I think on balance that neither one of those numbers reflects a great return on an investment of some $350 million. And when he came to calculating return to the shareholders on their investment, I think that realistically he should have included the fact that those shareholders and Reserve are obligated to repay some $160 million in indebtedness they are guarantors of, and the fact that Dr. Berryman chooses to ignore that I don't think changes that fact.

The total debt and interest to be paid by Reserve and by its shareholders as of December 1, 1969, the total debt and interest is $276 million.

I say this simply to perhaps set the record straight. No responsible official of Reserve Mining Company has ever said, as was indicated yesterday by one speaker, that Reserve would abandon its operation if a modification of its tailings disposal system was made. Reserve has not said that, has not threatened that, and I think that should be clear insofar as the record is concerned. And I think it is perfectly obvious that while engineering studies are progressing, that while Reserve is trying its level best to be in a position to evaluate engineering studies from the point of view of sound conservation, technical and economic feasibility, that obviously they couldn't reach any question of economic feasibility up until the time that the studies are far enough along to permit that kind of an evaluation.

Now, getting more to the point of possible modifications in the discharge of taconite tailings to the lake, there has been, of course, the summary that was issued on January 26 of 1970 by the Secretary of the Interior Hickel. Included was his recommendation that Reserve Mining Company be requested to undertake further engineering and economic studies relating to possible ways and means of reducing to the maximum practicable extent the discharge of tailings to Lake Superior and to submit a report on progress to the Minnesota Pollution Control Agency and the conferees within six months of the date of issuance of that summary. Of course, that six months would end July 26 of 1970.

Consistent with Reserve's policy statement, which was issued on September 2 of 1969 and widely published prior to the Secretary's summary, and without waiving any question as to the jurisdiction of this conference, Reserve reported on the progress of preliminary engineering studies considering possible modifications of the present method of disposing of taconite tailings. This report was made to the Minnesota Pollution Control Agency on April 13 of 1970 and to the conferees on April 30. Some 19 tentative plans were reviewed and the current status of those preliminary engineering studies was reported.

On July 29 of 1970, in response to a request from Mr. John Badalich, of the Minnesota Pollution Control Agency, Mr. Edward Furness, the President of Reserve, transmitted a letter summarizing Reserve's current situation and stated that, "We are in the process now of testing and translating laboratory data and drafting board information into demonstrable, reliable information."

Following Reserve's progress report to the conferees last April on preliminary engineering studies, every effort was made to hurry to completion the several studies which were unfinished at that time. As each was completed, Reserve began the second phase of the work, to prove and evaluate under simulated operating conditions in Reserve's pilot plant segments of some of the proposals.

Since last December Reserve's pilot plant, which represents the major portion of the $5 million Research and Development Division complex at Silver Bay, has been used exclusively to develop basic engineering data and evaluate portions of some of the preliminary engineering studies.

Gathering the basic data was of utmost importance, since preliminary engineering designs could not be completed without that information. The evaluation activities recently demonstrated their worth when segments of several preliminary engineering studies which appeared sound in the laboratory and on a drafting board failed in the pilot plant evaluation. They simply will not work and cannot be made to work because of the characteristics of Reserve's taconite or some other inflexible consideration.

The pilot plant proved this and is currently providing answers to many vital questions in this evaluation phase, such as:

> Will a particular flowsheet handle taconite from all sections of Reserve's mine? After all, the crude rock varies considerably throughout the mineral body in terms of grindability, concentratability, and so forth.
>
> Can a control circuit be designed to adjust the operations to accommodate these variations?
>
> What type and make of magnetic separators will perform at the efficiency and capacity indicated by preliminary engineering studies and lab experiments?
>
> Does the present plant have sufficient grinding capacity to permit the use of a fine screen circuit as indicated by the preliminary

engineering?

Which flocculents and amines will perform best from an operating, cost, and environmental standpoint? Of six flocculents which appear workable, only three have been evaluated in the pilot plant. The use of a flocculent or settling agent is required by all of the engineering studies employing thickeners or clarifiers and represents a major operating cost.

Will recycled water, containing some tailings instead of being clear, raw lake water, cause a buildup in continued operations and adversely affect the functioning of the process? And so on.

What is the feasibility of discharging tailings at a point 150 feet below the surface?

These and many other considerations are the practical questions that have to be answered. It is one thing, of course, to stand at a conference or something of that sort and say,"well, let's do this or let's do that," but we all know that practicality must be the test before any evaluation can be made to determine whether or not a modification in the discharge system is appropriate from a conservation standpoint and from a technical and economic feasibility standpoint.

So it is necessary to evaluate segments of some of the proposals contained in the preliminary engineering studies to make certain they are workable, sound, and also to determine rates of flow. Until these evaluations are complete, it is not possible for Reserve to make any kind of a meaningful decision relating to any modification or alteration of its method of tailings handling and disposal. Every indication is that these evaluation activities will be completed by November 1, 1970.

I have appended to the statement general details of the above general explanatory remarks. There is, of course, the letter from Mr. Furness to Mr. Badalich, and I won't take the conferees' time to read that.

There is a document that I think the conferees ought to pay particular attention to and that is because it presents for the first time to this conference a tailings inventory which is documented, which is established, and which has not been challenged. That tailings inventory and its attached maps show the location and thickness of the layer of tailings on the bottom of Lake Superior. The data represented in that survey represents a full year's effort, taking of bottom cores, the analyzing of each core's surface layer by x-ray and x-ray diffraction, chemistry. There was an acoustic sub-bottom profiling system, which is an extremely accurate depth sounder and standard surveying techniques were utilized.

As a result, virtually all of the 205 million tons of tailings that Reserve has produced in its 15 years of operation are accounted for on the bottom of Lake Superior. More than 90 percent are located within the 9-square-mile zone of discharge at Silver Bay, and the complete tailings inventory accounted for 98.5 percent of the tailings discharged. When one considers that in excess of a million tons has been used on highways, when one considers further that the beginning date that was utilized was a year earlier than when the survey was completed, and when one considers that there were various other uses to which tailings were put, virtually all of the tailings produced during the 15 years of operation are accounted for in that tailings inventory.

There is another memorandum, which is dated August 10 of 1970, from Mr. Kenneth Haley, the Vice

President and Manager of Research and Development, which is an inter-company memorandum, but we thought that the conferees should have the benefit of a detailed explanation of the engineering task force activities which are chronologically listed. It summarizes the extensive meetings, of planning sessions and reports and decisions that are made necessary and have been accomplished in consideration of this problem.

There is also attached a memorandum, again from Mr. Haley to Mr. Furness, which relates to the extensive work performed at Reserve's pilot plant, to which I have alluded earlier. It is a chronological summary of pilot plant activities and evaluates forces of various proposals. It includes summaries of meetings, purchase orders for equipment, work orders, test equipment, execution of engineering drawings, operating results, and other activities.

That takes care of the situation and reports on the situation as it is up to date. But there is further a memorandum which is attached which shows the project scheduling through October of 1970. It summarizes all of the evaluation projects scheduled by Reserve's pilot plant. Virtually any change in the method of tailings disposal brings with it the necessity of changing Reserve's basic processing system, the flowsheet that Reserve has pioneered and employed for some 15 years. The schedule that is appended shows the dates on which each of the investigations will be performed, inasmuch as a number of evaluations cannot be scheduled concurrently due to the large number of samples and laboratory analyses required.

We submitted at the April 1970 session a summary of the engineering data then available. We have updated that book and it is included in the exhibits which are appended. Because at that time a number of the preliminary engineering studies had not yet been completed, this book now has been brought up to date and new and supplemental information is printed on colored pages, with the newer revised sections indicated in the margins. I particularly direct your attention to Proposals 13, 15, 17, 18, and 19.

Digressing for just a moment, yesterday there was mention made of reports of the Minnesota Pollution Control Agency, and when one is testing the quality of the lake, I think that the State of Minnesota has adopted a very realistic and appropriate base upon which to test the water quality of Lake Superior and any particular effect that Reserve Mining Company might have on that.

In the first instance what it did was to make extensive surveys of the water quality before the plant ever went into operation so it would have a baseline upon which to compare any change or any impact on the water quality as a result of Reserve's operation. It has then extensively, through the Minnesota Department of Health, through the Minnesota Conservation Department, through the University of Minnesota, and through the Water Pollution Control Agency, as well as the Minnesota Pollution Control Agency, conducted extensive investigations right up to the present time to determine whether or not there was any adverse effect on water quality by the discharge.

I would like to submit for the record the most recent report, which became available in May of 1970, which is entitled, "A Report on Investigation of Water Quality of Lake Superior in the Vicinity of Silver Bay," by the Minnesota Pollution Control Agency, Division of Water Quality.

Mr. Chairman, I would like this to be made a part of the record as an exhibit, and I will supply the

Chairman with copies of same.

MR. STEIN: Without objection, this will be done.

(Which said report referred to is marked Exhibit 5 and is on file at the FWQA Headquarters in Washington, D.C., with a copy on file at the FWQA Regional Office in Chicago, Illinois.)

MR. FRIDE: I think it is important and significant to look at the conclusions that were reached by that agency.

One, the overall water quality of Lake Superior at the time of the survey in the vicinity of Silver Bay was found to be excellent at all sampling stations.

Secondly, no significant difference was found in the quality of the water outside of the Reserve Mining Company permit area and inside the area at the time of the survey, except for the 5-day biochemical oxygen demand, which was significantly higher outside the area. One sample taken approximately 15 miles southwest of the permit area had a lead concentration slightly in excess of the limit prescribed for Lake Superior by Regulation WPC 15. There was no apparent reason for this high value and further investigative work is indicated to establish its significance.

The Agency goes on to state that the investigation was for the purpose of determining if the water quality in and around the Reserve Mining Company permit area was being affected by the discharge of taconite tailings and to provide current information for comparison with the results of similar surveys done in 1948, 1953, 1955, 1958, and 1966.

And it goes on to report in detail that there has been no change in the water quality, that the water quality in and around the Silver Bay area is, was, and remains excellent.

I have referred to the problems associated with the examination and evaluation of various modifications. I have indicated in detail, I think, the depth and scope of the good faith effort that Reserve has and is making in this connection. In evaluating the conference record, it is respectfully suggested that analysis should include consideration of the significance to the lake of Reserve's discharge. On that premise it is submitted that the evidence does not show adverse effects on beneficial uses of the lake. Reserve has undertaken the engineering studies referred to not because the lake is being harmed by the company's present discharge system, but to determine if there is some other practical method or alteration which would relieve the concern some people have about the company's use of the lake.

It is anticipated that by November 1, 1970, sufficient information will be available to permit the company to assess any proposed alteration or modification from the viewpoint of sound conservation as well as technical and economic feasibility. The company should be able to report to the Minnesota Pollution Control Agency, as well as the conferees, its analysis and decision by December 1, 1970.

Reserve pledges continuing cooperation with the State and Federal agencies in attempting to arrive at an appropriate resolution.

Thank you.

MR. STEIN: Thank you.

Are there any comments or questions?

I think I have a few, Mr. Fride. I would like to say at the outset, that was a very comprehensive report, and I am going to place a restriction on myself. I know you did use some questions and answers of various participants, but I just am not going to at this point succumb to the temptation of talking about a case that is under litigation in a State or another court. I hope to confine myself to other questions. That doesn't mean that these issues might not be brought up at some later date.

I think we might have an interesting discussion, but after all is said and done I look at the key operative fact and the reason that I think I came here and we recessed this conference for six months. We were expecting a report from Reserve Mining on July 26.

As I understand it now, you indicate that we might have that report three or four months after that date, is that correct?

MR. FRIDE: Yes. I think, Mr. Chairman, that some consideration ought to be given to the fact that the summary of the conference by the Secretary issued January 26 did state that they wanted a progress report by July 26. Of course that was subsequently given in April, so I think that in that sense Reserve has fully complied with the conference summary. But I do suggest to you that Reserve should have a complete analysis of the decision for you by December 1.

MR. STEIN: You know, we will get into that, but I think these are the basic operative facts.

MR. FRIDE: Yes.

MR. STEIN: From July 26 to December 1 is four months.

MR. FRIDE: Yes.

MR. STEIN: Right. And essentially I think the operative fact is possibly we are dealing with a four months difference.

The notes that I have on what was asked for in this July 26 report I thought possibly was a little more than progress. It says that:

> The conference expects that Reserve Mining Company will have selected a plan, a combination of plans, or a series of alternates, including tentative time schedules--which I believe was put in by Mr. Mackie the last time--which Reserve Mining believes will prevent water pollution and will satisfy the regulatory agency. These plans, which are to be ready for detailed engineering, shall be submitted to the conferees not later than July 26, 1970. The conferees will consider the

plans of Reserve Mining Company at the next conference session to be held early in August--and I guess we are in the middle of August--at which time the conferees will make a judgment as to which of these plans, if any, will be acceptable. If none of the plans are acceptable, the conferees will make a judgment on appropriate further action to be taken.

This is the note I have on what was supposed to be done on the 26th. But at least we, I think, can come to an agreement that we don't have the report and you expect that we might have it in December?

MR. FRIDE: Yes. And I am sure the Chairman is well aware, the difference of the two is that the one I referred to is a summary issued by the Secretary of the Interior Hickel, and the comment that you just quoted from I am sure reflects the Chairman's statement at the conclusion of the April 30, 1970, session.

I just would like to add, of course, that every desire has been to comply and to report just as soon as humanly possible, and I think that some consideration must and should be given to the fact that, after all, it took some five years to design and construct this plant, and any suggested modification or alteration in the tailings disposal system is not as simple as it might appear to people who are just thinking in terms of the discharge, because it does require a substantial change in the various flowsheets, the very components of the operation.

So I think in that connection that Reserve really, and their engineering people, have made a very dedicated and a very exhaustive effort in that area.

MR. STEIN: Right.

Now, I think you said in your statement and quoted from Dr. Mount, anyway, and possibly Mr. Teasley, that they would like to extricate themselves from this case. I guess I can join them. I would like to do that too, and why not.

MR. FRIDE: I wouldn't mind myself, Mr. Chairman.

MR. STEIN: I understand that.

(Laughter.)

And the point is, I think this is exactly the point. I understand how Reserve feels, because they sympathize with them. I don't know that we can extricate ourselves from this case when there are questions open.

The problem, as you see, when we come back in a 6-month interval, is we may get other statements and other views dealing with interstate pollution that I am going to come up in a minute and have to evaluate. I think the conferees are going to have to evaluate it.

But I suggest, Mr. Fride, to you and your client that if Reserve had come up with these plans on July 26, these other questions might be moot at the present time on this interstate pollution. But not having come up with it, I think we have a problem that the conferees have to face.

MR. FRIDE: I am sure that there is much in what you say, Mr. Chairman. I suppose, too, that if the same kind of care and scrutiny were given to some earlier reports and statements as to various charges that have been made which have since been changed and abandoned that we might have a little different atmosphere in terms of the operation of this company, which I believe has been and is a very good citizen of this country.

MR. STEIN: Right.

You quoted Mr. Purdy on the presumptive evidence. I think Mr. Purdy and the other conferees have every right to expect after this time, if we have sufficient information in front of us, that we have to resolve that question. I certainly agree with Mr. Purdy that we should resolve this thing one way or another, and I will say I am going to ask the conferees at the executive session whether they have enough information before them now where they feel they can make a judgment on this question now. I would certainly agree with that.

MR. FRIDE: If I could just make one comment on that.

MR. STEIN: Sure.

MR. FRIDE: I appreciate, of course, that Reserve is not a conferee and not a party to the conference proceedings, but I do hope that in considering that particular question that some consideration will be given to the statements which have been made previously and also the one that will follow mine will be Dr. Lee, who, I think, will submit to you and to the conferees an analysis of the technical information that has been presented to date. I think as one of the conferees mentioned yesterday, there is always a problem in translating a few isolated laboratory experiments into any realistic concern in Lake Superior, and I hope that the conferees will give consideration to Dr. Lee's comments in that connection.

MR. STEIN: Right.

Again, you quoted several times statements attributed to Dr. Mount in communications and conversations about evidence of damage. I think yesterday we had an extensive discussion with the conferees on "endanger" and "damage," and I think Dr. Mount has made his position clear as to his views on that to the conferees. Speaking for myself, at any rate, I don't see any apparent contradiction with what was read in those statements and what Dr. Mount said yesterday and his further explanation and clarification.

MR. FRIDE: No attempt is being made to do anything except bring to the attention of the conferees the statements that have been made at other times and places for whatever significance the conferees wish to attach. I certainly don't mean any personal reflection on Dr. Mount. I do think, however, that on balance when one has perhaps some change in statements between a particular period in time that one might realistically ask what, if any, reasons are there for that, is there any additional data that is available, and that sort of thing. And I am not trying to suggest one way or the other in that connection, Mr. Chairman.

MR. STEIN: Right.

Now, there is one other point or some of these just factual points that I think should be covered. You mentioned Dr. Williams and his testimony. I believe Dr. Williams did appear before the conference and give a rather full report of his work in this area, so the conferees have the benefit of that because it is in the record. Is that correct?

MR. FRIDE: I am sure that is correct; that is right.

MR. STEIN: Now, at the beginning, in referring to the State trial and the indication of what would happen if a determination were made that there is no evidence of intrastate pollution, which is within the meaning of the State statutes, you said it would hardly be likely that there would be interstate pollution. I guess it might be that I could agree with that. But when you said that a corollary immediately came to my mind. That is, that if a body that was investigating interstate pollution found that there should be interstate pollution in Wisconsin, it would be even less likely that there wouldn't be any intrastate pollution.

MR. FRIDE: I would agree with that if that decision was made on all of the appropriate and available evidence, subject to some scrutiny, subject to an opportunity to cross examine, subject to a possible questioning of the data which led to various conclusions; certainly I would agree.

MR. STEIN: The last point is--I hope I can clear this up, at least from my point of view, once and for all and not have this again and again. And I would like to again give the information and I have said this publicly many times. This is about the Stoddard report and the Stoddard report forming the basis for the Secretary's calling of this conference.

1. I and my office prepared the papers, and I can tell you all that the Stoddard report did not enter into the considerations of this case at all. The Stoddard report was a report, of which the Department of the Interior may have four or five thousand a year, which goes in to the Corps of Engineers, the Bureau of Reclamation, the Federal Power Commission, the Atomic Energy Commission any time one of those bodies have a project or an application for a license before them. They routinely ask us what the effects on water quality are.

The Stoddard report was one of those in response to a Corps of Engineer request.

Things looked at in these reports are very much different than things looked at in an enforcement case. As I pointed out yesterday in several colloquys, the key jurisdictional factor we have in this case, when the Secretary issued the notice of the conference on his own initiative, is that pollution originating in one State endangered health or welfare of persons in another State.

Now, it is obvious when the Department of the Interior reviews a request from the Bureau of Reclamation, Corps of Engineers, Federal Power Commission, Atomic Energy Commission, it evaluates that not on the basis of the jurisdictional limitations of our enforcement authority but whatever effect it is going to have on water. And this is what the Stoddard report did.

I think we should once and for all disabuse ourselves of the notion that the Stoddard report was the basis of this or that the Chairman or anyone making a Federal presentation ever said that the Stoddard report did anything except present general information, and this is no indication that the Stoddard report didn't do the job that it was supposed to do, or that it related to this case.

The last time I was up here I went over that bridge out to a tent and had some smelt, and I agree with Mr. Fride, you have some wonderful smelt here. But until I heard about the Stoddard report I wasn't sure that you had red herrings. (Laughter.)

MR. FRIDE: Well, if I might just be permitted to make one comment in view of the last two words, Mr. Chairman. I do think that references were made, for example, to this conference by Mr. Risley, who appeared in May, who reported on various investigations that the Great Lakes office of the FWPCA had made. These conclusions that he reached really formed much of the premise and the basis for the Stoddard report, so that that information was transmitted to the conferees.

You will recall that, as you did yesterday, there is a certain amount of tendency, apparently, to translate particular discharges into pounds, tons, and sometimes I think the emphasis could be placed on really what significance is the substance with which we are dealing. There was talk yesterday by Dr. Mount, and I think some reference by the Chairman, to nutrients and then there was some association with taconite tailings. But on balance I submit that one would have to make a determination, as you suggested, Mr. Chairman. But I am not quite sure that the significance of what you said became apparent to all--that it is only what might be available to promote algae growth or any other kind of an effect on the lake that is of concern when we have, as we have with taconite tailings, the fact that for thousands of years there have been sediments deposited in Lake Superior, the natural sediments, that contain substantially more phosphorus, substantially more of many, many elements in them than do tailings.

And so I think it is important, again, to try to focus on what is available, as you have pointed out. Because if it is not available, then it can't be of any consequence to the water quality of Lake Superior or to any beneficial use of it. And I submit that that is a key thing that is sometimes overlooked. One is prone sometimes to recognize that there are some trace metals in the tailings, that is true. And it is a significant discharge, and that is true. And if you add up pounds out of tons you get to some high numbers, and that is true.

But then where you go from there is, I think, properly to be assessed as to what is available, what, if anything, goes in the solution, what, if any, nutrients are contained, and if you don't have those things, then I submit that it isn't proper to consider the discharge of any great significance. After all, again I refer back to the fact that for some 15 years this discharge has been going on. Do you see an algae problem in Lake Superior? The April report itself said:

> There is no overabundance of algae in Lake Superior. We regard the low temperature of Lake Superior as a limiting factor.

Now, that report says that. There is no bacterial problem in Lake Superior; there is no algae problem in Lake Superior. What justification, then, is there for the concept that because in a laboratory with use or, if I may suggest, some abuse of appropriate techniques one finds some slight stimulation that they might also find if they bothered to test natural sediments and then saying, well, suddenly, suddenly we have a problem? I don't really believe that that is the kind of a scientific inquiry that the conferees want to indulge in.

MR. STEIN: Mr. Fride, I certainly agree with you on the issues, but I think this is precisely what the conferees have to evaluate, the material on whether there are available nutrients and whether this is causing a problem or endangering health or welfare. Everyone is entitled to their judgment on the facts and I think we are going to have to do this.

I have no judgment on Lake Superior. But I certainly have a very clear recollection of Dr. Mount's saying that he saw algae on the shore. I remember years ago when I was working on the Lake Tahoe problem and I used to point to the algae on the shore and say, "How about that?" We were in the same kind of controversy, and then everyone got excited about that.

Now, I don't know that I myself am capable of making the judgment. But I think the way you place the question--and I think I said about the same thing yesterday--we are agreed on the issue, and we have to evaluate the evidence given here to see if there are available nutrients which are contributing to the accelerated eutrophication of the lake, of which the algal growth is one indication, or whether materials are put in in an inert form which do get transposed later on and contribute to this.

These are the questions, of course, that we have to look at, and I don't think that we are going to proceed on any other basis, and I am sure in our conversations with the industry that you regard the evidentiary prerequisites to be the same as we do.

MR. FRIDE: I hope that is true.

MR. STEIN: Yes.

MR. FRIDE: I would just comment on your reference to Dr. Mount's statement that he has seen some algae along the shore of Lake Superior. I think that that is probably hardly the kind of observation which Dr. Mount would credit in terms of any scientific inquiry. We do have, obviously, in this area a substantial amount of waste that is being deposited in the lake that comes from the sewer systems and comes from other sources. I recall reading in the newspaper the other day that there were some 20 companies over on the Wisconsin side that were discharging untreated sewage into the lake , and I suppose that every once in a while somebody might think just a little bit how about some focus on those kinds of situations rather than the hundreds of thousands of dollars of taxpayers' money which are being expended on what I submit to you are pretty--well, I would say pretty limited kinds of conclusions. I am not trying to assess the weight because I am sure that is something for the conferees, but, after all, I suppose that a pattern does emerge sometime here.

There is a charge, there is public attention given to the charge, and sometime later, quietly, there is perhaps a change or retraction or amendment or substitution. It doesn't, of course, attract the kind of notoriety that the first charge does, whether it is made by anybody who is in a responsible position or not. And over a period of time, when this has been going on since 1967, I would think the balance might suggest that inquiry--and I think Dr. Mount put it too--that there are a lot of sources of things in Lake Superior, and I suspect that while Reserve's may be one of the largest in terms of a discharge, it may be one of the most innocuous in terms of its actual effects on the lake.

But this, again, is a judgment that I am sure the conferees ought to give.

MR. STEIN: Thank you. You know, I hardly recognize ourselves with the charges. At least the criticism I get is that these conferees have been pretty slow and forbearing before they are making conclusions. I haven't heard any charges--

MR. FRIDE: I wasn't referring to the conferees in that connection, Mr. Chairman.

MR. STEIN: Are there any other comments or questions?

If not, thank you very much.

MR. FRIDE: Thank you.

May I introduce at this time--

MR. STEIN: I think we had better take a recess.

MR. FRIDE: Very well.

MR. STEIN: Let's have a 10-minute recess.

(RECESS)

MR. STEIN: We will reconvene.

Mr. Tuveson.

MR. TUVESON: Mr. Fride, will you continue?

MR. FRIDE: Thank you, Mr. Tuveson.

At this time, Mr. Chairman and conferees, I would like to call on Dr. G. Fred Lee, Professor of Water Chemistry, of the University of Wisconsin. He has had extensive investigation activities and analysis activities in assessing Reserve's discharge into Lake Superior. He is a consultant of President Nixon's Council on Environmental Quality. I think he is one of the fine men in his field and it is a pleasure to introduce him at this time.

G. FRED LEE
PROFESSOR OF WATER CHEMISTRY
UNIVERSITY OF WISCONSIN
MADISON, WISCONSIN

PROFESSOR LEE: Mr. Chairman, conferees, ladies and gentlemen.

My name is Fred Lee, and although I neither have a bald head, red beard, nor play golf like Arnold Palmer, I do feel I am qualified to look and comment on the topic of the effect of taconite tailings on water quality in Lake Superior.

For the past two years there have been numerous studies on the effect of Reserve's discharge of taconite tailings on the water quality in Lake Superior. These studies have been conducted by Federal and State agencies, by universities, by private individuals, and by the Reserve Mining Company. I think it is appropriate at this point to review the current information available as a result of these studies. Hopefully this review will help the conferees gain some perspective on the current information available and help them to make a decision on the course of action that should be followed by Reserve.

I propose to cover each of the major alleged potential effects by briefly reviewing the current state of knowledge and commenting on the significance of the results with respect to water quality in Lake Superior.

A written statement covering this review has been distributed to the conferees. A supplement will be issued in a few days which will cover detailed discussions of the algal stimulation studies presented yesterday. I will be happy to answer any questions that the conferees may have.

First I would like to look at the question of the distribution of taconite tailings in Lake Superior. At previous conferences we have had considerable discussion about the fact that Reserve's data on the amounts of tailings discharged to the lake shows a discrepancy with respect to the amounts found in the lake. As we heard from Mr. Fride, during the past year Reserve has conducted an extensive set of studies on the distribution of tailings in the lake. They have found that they can account for 98.5 percent of the tailings discharged to the lake during the first 15 years of operation. 45 percent of these tailings are located on the delta adjacent to the plant. In excess of 90 percent of the tailings are located within the 9 square miles discharge zone immediately adjacent to the plant and the remaining 8 to 9 percent are located in the deep trough area along the north shore. The 1½ percent discrepancy or apparent discrepancy is not real. This is within normal experimental error for this type of measurement. Certainly I wouldn't be surprised if Reserve had found a 101 or a 102 percent recovery for this type of thing because it is extremely difficult to do studies of this type.

With regard to the filling of Lake Superior, I think it is of importance to look at this question of just how much filling will take place in this lake. We have a deep trough along the north shore of Lake Superior. This trough is in excess of 900 feet deep for an area something like 20 miles long and 2½ miles wide. If Reserve deposited all of the total mineable ore that it has available to it in this deep trough evenly throughout this 20 by 2½ miles, we estimate that the amount of filling would be in the order of 30 inches. In other words, a couple of feet of filling of the lake. Now, the inventory of tailings clearly shows that most of the tailings are deposited immediately adjacent to the plant. Actually the amount of filling of the deep trough will be in the order of a few inches, the majority of it, rather than 30.

We do have some questions here about the fact that tailings cross the state line. We had considerable discussions of this question of do they cross a state line or don't they, and so forth. Well, there is no question in my mind that they do. They should cross. It should be very small amounts that would cross a state line.

However, I do not support the FWQA conclusion presented at the April 1970 conference that the amounts of cummingtonite found in a couple of cores located near the Wisconsin shore are evidence that Reserve's discharge resulted in tailings accumulated in the localized areas along the Wisconsin shore. I feel that there is insufficient data available today to support this conclusion.

There is no question that the sediments of Lake Superior have a certain amount of natural cummingtonite, a tracer of tailings in them. This amount of cummingtonite is in the order of 1 to 2 percent. Just because you find near the shore of Wisconsin some tailings or some sediments that have 3 to 4 or 5 percent cummingtonite in them, this should not be used without pretty careful study to show that it is discharged from Reserve.

My own experience in the area of working with lake sediments, particularly the near shore sediments of lakes, shows that they tend to be highly heterogeneous, and that is, the composition is highly variable from place to place. And it is improper, based on my work, to say that you can use the open water lake sediments off away from the shore as any criteria as to what may be happening in the near shore environment.

I think it is also important to point out that just because taconite tailings do cross a state line this does not mean that they cause any water quality problems.

Next I would like to turn to the question of green water. Lake Superior is an extremely clear lake. It is one of the clearest lakes in the world. We know that small amounts of turbidity of suspended solids present in the water will scatter light, and in the presence of Lake Superior water this makes the water look green to the eye. The amounts of turbidity that we are talking about in Lake Superior which cause green water are in the order of a few milligrams per liter. In most lakes of the world this would not be detectable. However, because of the extreme clarity of the water in Lake Superior we can see green water, particularly if you fly over it or you drive by it on the road.

I think the evidence is clear with regard to the fact that green water was present in Lake Superior prior to Reserve's operations on both the north and south shore of the lake.

The evidence is also clear that Reserve does increase the frequency of green water in the area of Reserve's discharge. There is no question, I think, in anyone's mind that there is some increase in frequency. However, it is important to note that not all of the green water present along the north shore today is caused by Reserve or the south shore or anywhere else in the lake, for that matter, and there is no evidence available today which can be used to assess the role of Reserve's discharge in increasing the frequency of green water in Lake Superior.

As far as the green water problem is concerned, it is strictly an aesthetic problem. There is no evidence to show that there are any other kinds of problems associated with it other than the fact that it may not be as likable to someone, someone who likes to look at blue water and they see green water, this is less pleasant to them. This is the problem we are talking about in green water, as I see it.

Next I would like to turn to bacteria. We have heard repeatedly here that there is no general bacterial problem in Lake Superior. The north shore water supplies are some of the highest in the world with respect to bacterial water quality. In fact, the bacterial quality of many of the water supplies, raw water, for the north shore is better than for many of the distributed waters in water supplies throughout the cities of the world. It is extremely high quality.

There have been some laboratory studies which show that tailings may act as a platform for the attachment of bacteria and bacterial food which will be derived from the water and that this type of association between tailings, its food, and the bacteria in the food, the particulate matter of tailings, might tend to stimulate bacterial growth. However, it is extremely important to realize that there is no organic matter or food in tailings which could be usable by the bacteria which cause waterborne disease, such as the typhoid or shigella or dysentery organisms.

We know from studies of bacteria in various types of water that normally bacteria in surface waters tends to be associated with solids. This is a common phenomenon. You find this throughout the world. If you want to look for the bacteria in water, you actually go to the solid surfaces.

We know also that the natural sediments, the suspended matters, so forth, in lakes should cause the same kind of a stimulatory effect that has been observed in the laboratory studies with regard to the growth of bacteria.

If anything, I think that the natural suspended sediments in Lake Superior, particularly those derived from dead remains of organisms and organic aggregates, would cause a greater effect on the stimulation of bacteria per unit concentration than any effects that would be noted from taconite tailings. The reason for this is that the organic remains of organisms can serve as a source of food while taconite tailings do not.

It is also important to realize that except in the permit season, and this is really only at the point where the density current goes down into the lake, the predominance of suspended particles in Lake Superior are not taconite tailings. In fact, as far as if you get any distance from the plant at all it is even difficult to find tailings suspended in the water. I, therefore, feel that any effects on bacteria in the lake would be completely masked by the natural particles and that there is no problem associated with the discharge of tailings on bacterial quality of the lake.

I wish to further point out that Reserve's operation may actually be increasing the bacterial water quality in the region of Silver Bay. The raw water taken in from Lake Superior by Reserve that is used in processing contains a certain low number of bacteria. These bacteria are derived from the tributary streams, from the cottages, from the resorts all along, villages, so forth, along the north shore.

Reserve's studies have shown that as this water goes through the processing in the plant many of these bacteria are killed. The grinding operations, the high-velocity pumping of the taconite slurry would tend to and does kill bacteria. Any bacteria that survive this operation which go out, say, the effluent of the plant, and there are some, would tend to be carried by the density current down to the bottom of the lake. We know the density current goes down there and, therefore, it is taking bacteria which are at the surface and carrying them down.

Again in terms of perspective of the lake, there is no bacterial problem in the region of Silver Bay and the fact that some are killed and some are carried down is of no significance in terms of overall quality of the lake, but I think it points to a direction in which things are going.

Next I would like to look at this question of algal stimulation and eutrophication of Lake Superior. Yesterday, in response to a question from Mr. Frangos on the significance of taconite tailings and water quality in Lake Superior, Dr. Mount said that the key effect is the accelerated aging or eutrophication of the lake. According to Dr. Mount this effect, when considered with other discharges, constituted interstate pollution, since it may endanger welfare of persons in other States than Minnesota. Because of the potential significance of these statements, I feel it is appropriate to review in some detail the technical basis for that, and I propose to do this.

First, Dr. Mount stated that there had been reports that the algal numbers in Lake Superior are increasing in the past few years. If we look at the basis for this data, we find that we are comparing some studies of various water supplies along the north shore; we are comparing some studies of the University of Minnesota, of professors, in which they took some samples of water in the lake; we are also comparing some studies of Dr. Beaton for Lake Superior to some studies conducted by Dr. Bright in working with Reserve in the past year.

First it is important to point out that the studies of the drinking water and the studies of Dr. Olson at the University of Minnesota are not comparable to Dr. Bright's studies. The procedures used by these other individuals did not collect or count all of the algae present in the samples and, therefore, the alleged change in the numbers of algae present in the lake because of this data is due to the fact that different analytical methods were used.

With regard to Dr. Beaton's studies, examination of the report for his studies shows that only three samples were taken in the western arm of Lake Superior in 1964. This is the only data available. Based on these three samples, there is simply insufficient information to make any judgment on the numbers of algae in Lake Superior as a result of Reserve's discharge. In fact, if you took and said that the three samples were reliable, you would have to conclude that the numbers of algae have decreased from 1964 until now.

With regard to Dr. Goldman and Dr. Shapiro's recent work on the stimulation of algae by taconite tailings, I wish to point out that these studies were of extremely limited scope and were prepared in the past few weeks for the Two Harbors trial.

In the case of Dr. Goldman's studies, where he did do duplicate experiments, we find that his data was badly scattered and applying normal statistical techniques to his data shows that there is no difference in the stimulation of growth or the--put it this way--there is no difference in the growth of algae in the presence of tailings than his controls. In other words, all of his results were within the normal experimental error for this kind of experiment.

With regard to Dr. Shapiro's results, he read only four samples with tailings. There was no replica data, no attempt to determine what the realiability of his data was. In fact, it is impossible to judge from his data the statistical validity of the results.

Dr. Shapiro did do extensive studies on the factors that limit algal growth in Lake Superior. These are studies that do not have any taconite tailings in them. These studies show and are in agreement with Reserve's studies in this area that phosphorus is one of the key elements limiting algal growth of the lake.

Laboratory studies conducted by some of my students have demonstrated that the phosphorus present in taconite tailings is not available for algal growth.

We cannot use the phosphorus present in tailings as a source for algae.

Phosphorus is present in tailings as a trace constituent. There are large amounts of phosphorus discharged to the lake via tailings. However, there is no evidence that the phosphorus present in tailings would be released to the water.

With regard to Shapiro and Goldman's work, I think it is important to note that they used the carbon 14 method of assessing the stimulatory effects of taconite tailings on algae. This method gives highly variable results. I think Dr. Goldman's data tends to show this where he ran replicas. There are very large errors likely to occur in this method because of the excessive incubation times that are used.

With regard to this method, I think it is important to note that currently the Federal Water Quality Administration Corvallis laboratory, several universities in the U.S. and some industries are attempting to develop what they call the provisional algal assay procedure or PAAP test. This test is designed to assess the potential fertilizing ability of some water or waste material on natural waters. The test has been in development for some two to three years at the present time. The initial draft of the PAAP procedure put out contained the C-14 method or carbon 14 method used by Dr. Goldman, and a recently revised draft of this procedure shows that this method has been deleted from it.

If we compare the three studies available, Dr. Goldman, Dr. Shapiro, and the Duluth FWQA laboratory studies reported on last April with regard to the stimulation of algae by taconite tailings we find that the results are quite different and somewhat contradictory. The FWQA studies show that the only time that they obtained statistically reliable effects of taconite tailings on the stimulation of algae was at very high concentrations of tailings, 10 percent tailings of a certain size.

Goldman and Shapiro, on the other hand, both found, if we could consider that the results were reliable, that only at low concentrations of tailings did we find a stimulatory effect. Higher concentrations of tailings with Dr. Goldman actually showed an inhibition of growth such that the growth was less than the controls.

Dr. Shapiro commented on the fact that the equilibrium concentration of phosphorus in the presence of tailings was 4 parts per billion. This statement is incorrect. The 4 parts per billion of phosphorus that he found in the sample of tailings which he obtained from the FWQA laboratory was derived from the intake water at Reserve. Had he analyzed the water taken into the plant at Reserve he would have found that the normal concentration of phosphorus in the waters of Lake Superior along the north shore is in the order of 4 parts per billion, so if you find 4 parts per billion coming out you can't infer from this that it is derived from tailings.

I want to comment just a moment on this problem of translating lab results to the field. We all have to do lab results. We have to do it this way. We can't possibly do everything in the field. But the lab results have to be used very carefully and we have to be cautious how we do them. We have got to start out with good lab results, first of all, and then once we have this, we have to go to the field to do some testing to be sure that it is reasonable.

Let me provide you with an example of how preliminary laboratory results can actually be misleading with respect to what may happen in the field.

The conferees may recall that at the first session of this conference I reported on some preliminary results obtained by the Reserve Mining Company on the sorption or removal of phosphorus from water by taconite tailings. These studies showed that in the presence of taconite tailings phosphorus in Lake Superior water would be attached to the surface of the particles, and since the majority of these particles are carried to the bottom of the lake outside of the zone of growth of algae, we find that rather than stimulating the growth of algae we would actually have a removal of one of their key elements and, therefore, tend to reduce the rate of eutrophication as a result of Reserve's discharge.

However, we have continued these studies both at Reserve and my own laboratories, and we can state now that if you use the concentrations of tailings that are likely to become temporarily suspended in the surface waters of the lake, and you use the concentrations of phosphorus that occur in the lake normally, that there will be no removal of phosphorus by taconite tailings. In other words, adsorption studies show that at realistic concentrations there is no effect, there is no sorption.

Now, I submit that the algal stimulation studies produced thus far are similar in character to the preliminary studies that we reported on in May 1969.

Further studies will most likely show that these apparent stimulations are not real as far as the lake is concerned

I think it is clear that we have no algal problem in Lake Superior today, nor is there any evidence that the numbers of algae present in this lake have changed in the last 20 years. If a change should be found, in my opinion, it is more likely due to the phosphorus derived from the sewage effluent from various municipalities than from any discharge from Reserve.

Next the question of solubility of tailings should be considered. In the way of background information we have the fact that there has been no increase in the dissolved solids of Lake Superior in the recorded history of the lake. In the region of Silver Bay we have the same dissolved solids content as we have in any other part of the lake. It is not higher there or lower or anything than anywhere else.

We also know that the processing of taconite tailings does release some dissolved solids. We heard this morning about the addition of calcium chloride to the ore to prevent it from freezing during the winter. This, of course, winds up in the lake during the winter periods. We also know that in some long-term leaching tests that small amounts of dissolved solids are released to the water.

The materials that are released are of the common cations and anions that are normally present in the water, the common chemical constituents. They are not the kinds of things that we would normally worry about in any respect.

But using the best information available today, Reserve's discharge may increase the dissolved solids content in Lake Superior in the order of 0.1 to 0.2 milligrams per liter in 50 years. Now, this type of increase, when we consider that the background concentrations are in the order of 57.5 milligrams per liter near Silver Bay, we are talking about an increase to 57.6 or 57.7. This kind of an increase is not even measurable by the techniques used to measure dissolved solids.

I think it is also important to note that in excess of a million pounds per day of dissolved solids are added to Lake Superior from various tributary streams. This is the material that comes in normally to the lake every day.

Next the question of water quality for water supplies. We have been told, as we have heard from various people here, that there are no water quality problems with respect to water supplies along the north shore or as far as I know anywhere else in Lake Superior. There has been no increase in turbidity of the north shore water supplies as a result of Reserve's operation. There has been no greater frequency in filter backwash at the Silver Bay plant that could be attributed to Reserve. The raw water quality of the water supplies along the north shore of Lake Superior is among the highest in the world with regard to turbidity, bacterial and chemical composition.

Toxicity. There seems to be no problem with regard to the discharge of taconite tailings on toxicity. Tailings do contain potentially significant amounts of copper, zinc, nickel. If this material were available to the water, it could be toxic. However, all studies, I think, conclusively show that it is not available.

Bottom fauna. We have had previous reports at this conference that there are changes in the numbers of bottom fauna in the region of Silver Bay. I believe that this was used to support the statements with regard to presumptive evidence. Further studies have shown that these changes are very minor, if real at all. We know from these further studies that you must take very large numbers of samples to obtain any kind of a reliable estimate of the numbers of bottom organisms in Lake Superior.

The changes that have been noted are such that we can say qualitatively the types of bottom fauna are the same in the zone of discharge as compared to outside the zone of tailings that are being deposited. The same kinds of organisms are present and if further studies show that the bottom fauna were changed from, say, 42 percent pontoporeia to 45 percent or some figure like this, I certainly do not feel that we can state, because of this change, that this represents a deterioration in water quality. These minor changes are not of significance.

In conclusion, I wish to state that a critical review of the information available to date shows that Reserve Mining Company's discharge of taconite tailings does not have a significant deleterious effect on water quality for any beneficial use of the lake. The only effects that have been noted are localized and are due to an increase in the frequency of green water. This is an aesthetic effect. There is no evidence, in my opinion, to show the deleterious effect on water quality in the States of Wisconsin and Michigan.

MR. STEIN: Thank you, Dr. Lee.

Do you want this statement to appear in the record as written as if read?

DR. LEE: Yes, sir.

MR. STEIN: Because I know you did summarize.

(Which statement appears herein at pages 450 to 469, inclusive.)

MR. STEIN: Sir, I appreciate listening to you again. And you know, when you are around as long as I am, you get the notion sometimes that you don't hear anything new. I was going to say I didn't know what I heard that you put out here that I didn't hear before at previous sessions, but you have one great new idea and I think we should pursue it, because I think this might give us the answer to the problem.

Taconite tailings have no deleterious effect, you say, except for creating a little green water, which may be an aesthetic problem, but they do reduce the bacteria. Now, here we have problems in Lake Ontario, Lake Erie, Lake Michigan, certainly on the Sanitary Ship Canal coming down from Chicago, which is easily accessible. What would you think if we got together or I got together with the Federal Government, as I do, in cooperative programs with the other States--Michigan, Wisconsin, Indiana, Illinois, Ohio, Pennsylvania, New York--and ask them to join with us and contribute and get some barges and take this stuff out to where we have bacteria and just sprinkle it around? That is, if we can persuade Minnesota to give up this valuable material.

(Laughter.)

DR. LEE: I really can't speak for the company, but I am sure they would be in favor of it.

MR. STEIN: That's great. I hate to see these 60,000 tons going to waste of bacteria-killing material that have no apparent harm. It is right on the waterfront.

Are there any other comments or questions?

Mr. Purdy.

MR. PURDY: Dr. Lee, you have made quite a point about this problem of translating laboratory results to field conditions, and I think all the conferees recognize this problem. But again I would hope that in, say, a situation such as being considered here today, that is Lake Superior, that it can be recognized that a lake does not respond to an input of a foreign substance in the same way as a river. And I would hate to think that in this day and age that we could not consider sound laboratory results and take action based upon those results prior to seeing a detrimental condition occur in a lake of the size of Lake Superior. I think we have to do this.

DR. LEE: Yes, I would agree. I think that in my statement, I want to reinforce what you have said with regard to sound laboratory results. I think we have to look to laboratory results as a guide to this.

I also think, though, that we can detect, if we are willing to go to the field and conduct the proper studies, changes which would show deleterious effects if they do occur. I do not agree with some of the statements that you will never see a change even though effects are occurring. We are talking about increasing algae, we are talking about dissolved solids or other things. Our techniques are sufficiently reliable today so that we can do this if such an effect is occurring.

So I think that you can use laboratory results as a guide. If I may comment on one thing further with regard to the PAAP test. We are not in any kind of position today to judge the relationship between the stimulatory studies of algae in the standard laboratory condition to that which would occur in the lake. The current PAAP test is like the BOD test was in the thirities. You know, it took many, many years to develop the BOD so that it became empirically correlatible with what happens in the field. Some day we will have the same kind of thing with PAAP, but we are a long ways from it right now.

MR. STEIN: But until the day, you are in favor of discharging 67,000 tons of this a day into the lake?

DR. LEE: I see no deleterious effect from this.

MR. STEIN: All right, great. I just want to get your position clear.

MR. PURDY: Mr. Stein, I would like also to ask Dr. Lee if you are conducting or if the company is conducting studies as to the effect of tailings on increased algal growth and, if so, what are the results of those studies?

DR. LEE: I have conducted studies with regard to the availability of phosphorus in tailings as a source to algae, and the results thus far, as I said, show that the phosphorus present in taconite tailings, using the best available PAAP procedure, is not available for algae. In other words, it is a BOD type of experiment in which we try to see whether it is available in the cultures, set up the conditions so that the algae will grow on everything else that is present there except they are limited by phosphorus, and they can't get the phosphorus based on our results.

MR. PURDY: But you have not conducted studies, though, that would refuse the type of information that Dr. Shapiro reported yesterday?

DR. LEE: I have not conducted studies which would say that there is no material present in taconite tailings which would not stimulate the growth of algae. I have looked specifically to phosphorus and I think phosphorus is without question one of the key elements in the Lake Superior system.

MR. STEIN: In all fairness--and let me put it this way--as I recall Dr. Shapiro's testimony, and I recall it very clearly, Dr. Shapiro said that in his opinion it is either phosphorus or manganese, one or the other, that causes growth. He said that taconite tailings caused the increase. As I recall his testimony, he did not 100 percent attribute this to phosphorus or any particular element, but he gave you two to choose from, as I listened to him.

DR. LEE: All right, can I comment on this?

Because I think it is important.

Shapiro did two types of studies, one in which he took samples from various parts of Lake Superior up near Grand Marais, and he looked at what might be the limiting element in the growth of algae. All right. From these studies he found, as I recall, that in the near shore samples phosphorus was the key element. In other words, silica, iron, manganese, nitrogen did not stimulate the growth of algae. Only phosphorus. In the offshore samples from Grand Marais he found that he got a stimulation from both phosphorus and from manganese.

Now, with regard to manganese, now, there is no question about the fact that taconite tailings do contain manganese and that as part of the processing we do have a release of manganese to the water. However, our current knowledge of manganese chemistry will clearly show, and our data in the field also substantiate this, that manganese would not remain in solution, that manganese would be oxidized to manganese dioxide and precipitated to the sediments. So I don't see any problems from manganese and algae in Lake Superior at all as a result of Reserve Mining.

MR. FRANGOS: Dr.--

MR. STEIN: Go ahead. Again I think Dr. Shapiro's testimony speaks for itself. I am not sure that that answers it.

MR. FRANGOS: Dr. Lee, a little bit more on this PAAP test. And I think perhaps your committee might have chosen another acronym when you were getting into this. (Laughter.)

But at any rate, I am wondering if you could just go into a little bit more detail where this work stands on the carbon-14 technique. You at least touched on the matter that the committee has apparently rejected this in its second draft. And could you just give us what went into this thinking of the committee, as you know it, at least?

DR. LEE: Well, I am not really on the committee. I am associated with Dr. Fitzgerald, Dr. Gerhold and others at the University of Wisconsin in my laboratory who are actively involved in the drafting of the revised PAAP procedure.

My understanding of what has happened here is that the committee members felt that the carbon-14 procedure was not a reliable test in order to assess what is going on.

I don't know if that answers your question, but there are many problems with the test.

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes, Mr. Badalich.

MR. BADALICH: If I might interject here.

Dr. Lee, have you ever used the carbon-14 technique in your analysis to get a comparison with Dr. Goldman and Dr. Shapiro's studies?

DR. LEE: I have used the carbon-14 technique, but not for this purpose. I would not use it as they have done until I had done some pretty extensive studies to see whether there any errors with the long-term incubations that they used. It is clearly stated in the literature by Dr. Goldman that you should limit the incubation periods to a few hours, not to many days as they have done.

MR. STEIN: I am sorry, Dr. Lee, your answer to that question is no, did you have it?

DR. LEE: Did I have--

MR. STEIN: Your answer--

DR. LEE: That I have used the C-14 to--

MR. STEIN: No, your answer.

DR. LEE: No.

MR. STEIN: The answer is no?

DR. LEE: That is right.

MR. STEIN: All right, thank you.

MR. BADALICH: Would there be any validity in undertaking further studies to use this technique to try to get a correlation or a comparison with these studies?

DR. LEE: Yes, I think there would be. I think it may work, you know. I can't rule it out. I know there are many problems with the tests and I wouldn't accept the results until these problems have been investigated.

MR. BADALICH: But you also stated that the scientific community now is going to abandon this type of technique and go into the PAAP--

DR. LEE: No, I didn't say that. I said--

MR. BADALICH: You are leaving that impression, at least with me.

DR. LEE: Well, I leave the impression that as far as the future developments of the PAAP procedure that it will not be included in it. Now, it might come back again, you know. This is still in very early stages of development, but there is a lot of work that has to be done on it as well as many other types of tests before you can decide on what to use.

MR. STEIN: Any other questions or comments?

If not, thank you very much, Mr. Lee.

Mr. Badalich, does Minnesota have any more?

MR. BADALICH: I believe Mr. Fride wants to conclude the presentation of Reserve Mining.

MR. STEIN: All right.

MR. FRIDE: Yes, I would like to ask the conference, as soon as the supplemental study or supplemental report of Dr. Lee is available if it could be transmitted to the Minnesota conferees for transmittal to the other members of the conference?

MR. STEIN: Yes. How long will that be?

MR. FRIDE: I think just a few days, Mr. Chairman.

MR. STEIN: If it comes in in a few days, we will make it part of the record.

(The above-mentioned supplemental statement follows)

MR. FRIDE: Thank you.

That concludes the presentation of Reserve Mining Company.

MR. STEIN: Thank you very much. Mr. Badalich.

MR. BADALICH: Mr. Chairman, I believe that concludes the presentation of Minnesota or representatives from the State, so I turn the chair back to you.

SUPPLEMENTAL STATEMENT
TO THE AUGUST 12-13, 1970
SESSION OF THE LAKE SUPERIOR CONFERENCE

By G. Fred Lee

In response to a question from Mr. Frangos on the significance of taconite tailings on water quality in Lake Superior, Dr. Mount said that the key effect is accelerated aging or eutrophication of the lake. As I interpret his statement, all other alleged effects that have been proposed at previous sessions of the Conference are now essentially reduced to one--eutrophication. According to Dr. Mount, this effect, when considered with other discharges, constitutes interstate pollution since it may endanger the welfare of persons in states other than Minnesota.

Because of the potential significance of these statements, I feel it is appropriate to review in some detail the technical basis for them.

Dr. Mount commented that there have been reports of increased algae in Lake Superior in recent years. I believe that the purported support for this statement is based on the testimony of Dr. Beeton compared with more recent data gathered by Dr. Robert Bright for Reserve. Dr. Beeton's data consisted of some samples taken in 1964 in which only three sampling stations were in the Western arm of Lake Superior. Two of the sampling stations were located near the Apostle Islands. These two stations had numbers of diatoms that were greatly in excess of any found by Dr. Bright in his studies for Reserve or by Dr. Beeton for other parts of Lake Superior. Obviously, Dr. Beeton's 1964 diatom data cannot be used to evaluate recent changes in the numbers of these organisms.

Similar problems exist for the Public Health Service-Federal Water Quality Administration Water Quality Network data and Dr. Theodore Olson's data on Lake Superior. Both of these sources of data used analytical procedures that make a comparison between them and Dr. Bright's data impossible. Dr. Bright's technique counted all of the organisms while the method employed by Dr. Olson measured only a part of the organisms, and the PHS-FWQA uses a different counting method. These are examples of why comparisons between these techniques cannot be made.

Dr. Ruth Holland Beeton, in discussing the Beeton study, stated (Publication #13, Great Lakes Research Division, the University of Michigan, 1965):

> "Relationship to Other Studies
>
> "It is difficult to compare this study with others in Lake Superior because of differences in sampling locations and techniques.
>
> "Putnam and Olson (1961) counted diatoms in a Sedgwick-Rafter cell at a magnification of 200 X. At this magnification it is very difficult to discern, and impossible to identify to genus, Cyclotella in the smaller size ranges into which Cyclotella glomerata-stelligera and Cyclotella ocellata-kutzingiana fall (lower limit 2 µ).
>
> "Williams (1963) stated that he counted diatoms 4 µ or larger in a Sedgwick-Rafter cell. He grouped small diatoms into two categories--centrics and pennates--and subdivided the number of these diatoms according to the percentage occurrence of genera and species found on Hyrax slides at a magnification of 900 X. The smaller species of Cyclotella would not be detected in the Sedgwick-Rafter count. Consequently, they would not be included in the final count, even though they were detected on the Hyrax slides. The colonial form of some of the small species of Cyclotella would

> further diminish their number, because a natural aggregate occupying up to 300 μ^2 would count as one unit. Such an aggregate could be composed of 30 Cyclotella frustules, each measuring 5μ by 2μ.
>
> "As compared with the present study, the higher percentages of Melosira, Tabellaria, and Asterionella and the lower percentages of Cyclotella found by Putnam and Olson and Williams may have resulted largely from differences in methods."

Also, I wish to point out that finding some algae on rocks along the shore of the lake today does not mean there was more or less algae on those rocks yesterday--or last year--or 20 years ago. It is no indication that the rate of eutrophication has been increasing in recent years, any more than it indicates that the algae found by Dr. Mount is in any way associated with taconite tailings discharged by Reserve Mining Company.

Dr. Goldman's and Dr. Shapiro's studies on the effect of taconite tailings on the stimulation of algae were extremely limited in scope and done in the past few weeks for the Two Harbors trial.

Dr. Goldman ran duplicate experiments, but the data was so badly scattered that all of the results from samples containing taconite tailings were within the normal experimental errors of the controls that did not contain taconite tailings. Therefore, no conclusions can be supported by that data.

Dr. Shapiro ran tests on only four samples which contained taconite tailings. He ran no duplicate samples. This is insufficient data on the effect of taconite tailings to even judge the statistical validity of his results. I know from experience in conducting studies of this type on a variety of natural waters that no meaningful results can be obtained by only four experiments of this type. The nature of such experiments makes it necessary to perform many replicate studies in order to determine the best evaluation of the relationship between the parameters under investigation on the growth of algae. The majority of Dr. Shapiro's studies were not related to tailings. They were devoted to an investigation of the factors that limit algal growth in Lake Superior. These results are in agreement with Reserve's studies which show that phosphorus is probably one of the key limiting elements in controlling algal growth in this lake. Laboratory studies conducted at the University of Wisconsin under my supervision have shown that the phosphorus present in tailings is not available for algal growth.

It was stated at the Conference that large amounts of phosphorus are discharged to the lake by Reserve's discharge of tailings. While phosphorus is present as a trace element in taconite tailings, there is no evidence to show that it would be released to the water in the Lake Superior environment. In fact, all available evidence shows tailings tend to sorb phosphorus from lake water rather than release it.

Both Dr. Shapiro and Dr. Goldman used the Carbon-14 method in attempting to measure algal stimulation by taconite tailings. This method is subject to many errors. They both used excessively long periods of incubation (days) which could have caused large errors in results.

Dr. Goldman, in a chapter entitled, "Bioassays Technique, The Nutrient Limiting Factors," states on page 81 of A Manual on Methods for Measuring Primary Production in Aquatic Environment, edited by R. A.

Vollenweider, IBP Handbook No. 12, F. A. Davis Company, Philadelphia, Pennsylvania, 1969, that, "In general, incubation time should be kept to short periods (two to six hours) to limit the influence of bacteria growth on results." The Federal Water Quality Administration, several universities and industries are in the process of developing the Provisional Algal Assay Procedure, or PAAP test. The initial draft of the manual for this procedure contains the Carbon-14 method as developed by Dr. Goldman. In a recent draft of the PAAP, the Carbon-14 method has been deleted as a technique for evaluating the potential availability of algal nutrients in natural waters.

Reserve has previously commented on the inadequacies of National Water Quality Laboratory, Duluth, studies on algal stimulation by taconite tailings which was presented at the April 29-30, 1970, Conference. In my opinion, the most significant deficiencies of these studies were the excessively large numbers of algae used and the fact that the taconite tailings were heated to 60°C for one-half hour prior to use in the study. The only time they were able to obtain a statistically reliable effect by taconite tailings on algal growth (which differed from their controls) was when they used ten per cent tailings. This concentration of tailings is considerably in excess of any concentrations of tailings that would ever be found in Lake Superior water outside of the density current near the point where Reserve's tailings are discharged to Lake Superior.

The Federal Water Quality Administration personnel who conducted this study attempt to show that the release of silica from taconite tailings is the cause of the algal stimulation that they observed. However, Dr. Shapiro's data on the limiting factors in Lake Superior water demonstrates that silica was not limiting the growth of algae in the samples that he studied. In addition, examination of the water chemistry data for the lake clearly shows that silica does not limit diatoms in this lake. A comparison of the results of the three studies (Federal Water Quality Administration, Dr. Goldman, Dr. Shapiro) shows that if the results could be considered as reliable, they are somewhat contradictory. The FWQA only found stimulation at very high levels of tailings. Both Dr. Goldman and Dr. Shapiro showed that tailings stimulation would only occur at low levels and inhibition would occur at intermediate levels of tailings.

Dr. Shapiro was incorrect when he said that the equilibrium concentration of phosphorus in the presence of tailings is 4 ppb. This number was based on the fact that the sample of taconite tailings supplied to him by the FWQA had 4 ppb of non-filterable phosphorus in it. A sample that was supplied to him was obtained from an intermediate step in Reserve's processing. If Dr. Shapiro had analyzed the intake water for Reserve Mining Company, he would have found that it normally contains about 4 ppb of phosphorus. Therefore, this amount of phosphorus in the plant effluent is to be expected and it certainly cannot be inferred that there was any release of phosphorus by the tailings. In my opinion, the three studies that have been reported by the FWQA, Dr. Goldman and Dr. Shapiro cannot be used to support a claim that taconite tailings have an effect on the eutrophication of Lake Superior.

In the preparation of this supplemental statement, I had originally intended to only discuss the work of the National Water Quality Laboratory, Duluth, Dr. Goldman and Dr. Shapiro to show that the data provided by them did not support the conclusion that the discharge of taconite tailings to Lake Superior by Reserve Mining Company was causing an accelerated eutrophication of Lake Superior. However, as a result of the decision of the Conferees that Reserve, among others, was causing interstate pollution of Lake Superior, I wish to expand my presentation to include a discussion of the role of technical information in making public policy decisions in water pollution control. As an educator whose primary objective is to train students for research careers in water pollution control where the results of their investigations will be used to assist in public policy decisions, I have become increasingly concerned about the role of technical information. I feel that it is appropriate to include a discussion on this topic in the record of this Conference since there is such a large discrepancy between the technical information available on the deleterious effects of the discharge of taconite tailings on water quality and the conclusion of the Conferees that this discharge represents interstate pollution.

We are currently operating in this country with the general philosophy that in order to bring about the control of water pollution, it must be shown that a material or significant deleterious effect of a particular discharge has been made on a beneficial use of the receiving water. This approach has worked reasonably well for such discharges as untreated municipal waste waters. However, serious problems have developed in the application of this approach to the more subtle effects of water pollutants such as chronic toxicity of trace metals to aquatic organisms or the fertilization of natural waters by aquatic plant nutrients. In the case of the latter, it is being found with increasing frequency that technical information is being used as the basis for making public policy that actually is not supported by scientifically reliable data. Major decisions on water pollution control normally have political, economic, social, legal and technical (scientific and engineering) components. Often, in the most subtle aspects of water pollution control, the technical component of decision-making is extremely limited. There has not been sufficient funds and qualified manpower to answer all of the questions on the relationship between a certain type of discharge to its effect on water quality. This does not mean that the decisions should not be made--they should. We cannot wait until all the answers are in before a decision is made. However, the public should be promptly informed as to the basis for a decision. They should not be led to believe that there is a valid, technical basis for a certain decision when, in fact, this is not always the case. To the layman, one side's testimony is about equal in weight to another's. Accordingly, the layman chooses to believe whichever side presents information which supports his conclusion. However, in general, the scientific community knows what constitutes reasonable scientific evidence to support a decision on water pollution control. Certainly, one should not accept as a creditable scientific study an experiment on the growth of algae in which only four flasks were used with no replicates and no estimate of the error of measurement nor the applicability of the measuring method to the system under study. In my opinion, this type of data should not be presented at an Enforcement Conference, hearing, or trial. It would never be accepted among the scientific community, yet it is presented with apparent equal validity to studies that were conducted over several years and in which great care was placed to see that the data presented supported the stated conclusions.

The situation on phosphorus removal from waste water entering Lake Michigan is a good example of how the public has been misled with regard to the technical information available to support the decision of 80% removal of phosphorus from all waste waters entering the lake.

There still is no reasonable amount of technical evidence to support the conclusion that the removal of 80% of the phosphorus from waste waters going into Lake Michigan will result in improved water quality. Yet, I am certain that if you ask the public the question of whether they expect water quality to improve as a result of spending billions of dollars for phosphate removal, they would in general say, "yes." There are some who argue that even if there is insufficient technical data to back up such a decision, it is still the correct way to proceed since we are moving toward protecting the lake from a potential problem. From the technical point of view, this statement is true, but from an overall resource management point of view, it may be far wiser to spend the limited funds available for pollution control on problems where it is known that improved water quality will result. If we do not follow this policy, we are likely to find that the public will become increasingly reluctant to support water pollution control efforts because previous efforts have not resulted in improved water quality.

There is a mistaken belief by some that it is proper for industry to spend large sums of money for waste treatment--even in areas where little or no benefits in improved water quality are likely to be derived. Yet, these people do not apply equal standards to municipalities. They say, in effect, "Large industries can afford it while individual taxpayers cannot." In our economic system, there is no such thing as money which is exclusively industry's. With few exceptions, all of the funds used for industrial, agricultural or municipal waste treatment come from the public in the form of higher prices for the product, less return to stockholders, etc.

Recently, I was asked by the President's Council on Environmental Quality to advise them on what should be done with regard to a national policy on the removal of phosphorus from waste water effluents and the removal of phosphorus from detergent formulations. After careful review of the social, political, economic, legal and technical aspects in this question, I have decided to support both of these efforts. Several years ago I would have recommended against them since the technical evidence was very meager and would not, in my opinion, warrant the expenditure of the large amounts of funds needed to remove phosphorus from waste waters and from detergent formulations. However, today as a result of several years of intensive study, there is no doubt that phosphorus is one of the key limiting elements in the growth of algae in many surface waters of the country.

Even though there is insufficient information available today to estimate the benefits in improved water quality that may result from the expenditure of funds for these purposes, I feel that there is sufficient evidence to warrant the expenditure of substantial amounts of the financial resources of this country to help eliminate some eutrophication problems in some of the nation's waters.

During the course of the August 12-13 Conference, we heard several comparisons made between the "mercury crisis" that exists today and the potential problems that could result from taconite tailings in Lake Superior. It was stated that several years ago no one would have predicted the current mercury crisis and, therefore, how does one know that there will not be a taconite crisis in a few years? I submit that it is completely improper to compare the mercury situation to taconite tailings. In the case of taconite tailings, we have had some 15 years of operation with detailed studies by several agencies of the State of Minnesota on the effects of Reserve's discharge on water quality in Lake Superior; there is convincing evidence that water quality of municipal water supplies along the North Shore of Lake Superior has not changed as a result of Reserve's operation; there have been extensive studies of the effect of taconite tailings on water quality during recent years. All of these studies show that the only technically sound argument for having Reserve Mining Company change its method of disposal of tailings is that the current method of discharge does cause a highly localized temporary increase in the turbidity of the water in the region of Silver Bay which results in appearance of so-called "green water."

All other alleged effects of taconite tailings on water quality in Lake Superior are not supportable due to insufficient technical data, or have been shown to be unimportant and of no consequence in Lake Superior.

In the case of mercury, there were no studies on the concentrations of mercury in fish prior to this year. The analytical methods that were used to determine mercury levels in water, although adequate to protect water supplies from direct human consumption of excessive mercury, were insufficiently sensitive to detect that concentrations present in the water are sufficient to build up to potentially dangerous levels in fish. Analytical procedures were available for several years to detect mercury at these levels, but they were not used.

One of the reasons why the mercury problem was not detected earlier is that there were insufficient funds available for exploratory research of the type needed to detect problems of this nature. This situation still exists today as demonstrated by the fact that in the spring of 1970, the Federal Water Quality Administration Division of Manpower and Training, turned down a $5,000 per year request of mine to support a graduate student who would study the sources, amounts and reactions of zinc in Eastern Lake Superior--because such a study was not in accord with the primary mission of the FWQA.

There is little doubt in my mind that this nation will experience a series of mercury-like crises in the next few years. There is an urgent need to change the current policy on the support of research of federal, state, university and industry laboratories if we are going to minimize future problems of this type.

The reason we have a mercury crisis at this time is because of inadequate research. This has not been the case with taconite tailings. As stated above, there have been many studies on the effect of taconite tailings on water quality. All of them show that there was no significant or material deleterious effect on the lake. Effects found in the laboratory are not applicable to the lake conditions or are insignificant, or the results obtained to date are insufficient to make any valid judgment. The three experiments on eutrophication of Lake Superior by taconite tailings fall into the latter category.

It could be argued that a similar approach be taken on taconite tailings discharged in Lake Superior as was used to curtail the phosphorus input to Lake Michigan as discussed above. The Conferees could decide that since no knowledgeable scientist or engineer would testify that there was a 100% certainty that there never would be any release of materials from taconite tailings discharged to Lake Superior that could accelerate eutrophication of the lake, then the "safe," conservative approach should be taken: Reserve would alter its method of disposal. However, the public should be clearly informed that there is no real basis for such a decision and that there is no valid evidence to show that Reserve's discharge has, in fact, caused an acceleration of eutrophication.

In my opinion, since large amounts of funds will be needed to alter Reserve's discharge, a much more reasonable approach would be to have the Conferees and Reserve initiate a thorough study of the potential fertilizing effects of taconite tailings in Lake Superior. This project should consist of a series of technically sound laboratory and field studies which are specifically designed to answer the question: Does the discharge of taconite tailings by Reserve Mining Company represent any real threat to the eutrophication of Lake Superior and if so, what is its significance? In order to minimize some of the bias that can enter into studies of this type, a panel of nationally recognized experts in the area of eutrophication, algal nutrition, limnology, statistics, bacteriology, sanitary engineering, and water chemistry should be appointed to define the studies that should be conducted, evaluate progress and prepare a final report--with recommendations for action by the Conferees. An additional two years of study will not, in my opinion, cause any significant increase in eutrophication of Lake Superior if such an effect should be found by the study. It is obvious from the data available that any effect of this type would be extremely limited, in view of the tonnages of tailings added to the lake in the past 15 years.

This approach need not delay Reserve's initiation of an alternate method of disposal. The firm has pledged to proceed with its current studies on process and discharge modification. This eutrophication study would make a significant contribution toward helping the Conferees and Reserve to decide the type of alternate method that is needed to correct potential problems.

It is logical that the alternate method of disposal chosen should be dependent upon the nature of the problem caused by the current method of disposal. It is quite possible that some of the alternate methods under consideration could lead to real eutrophication problems. There is little doubt that the potential effects of any proposed alternate method of disposal must be thoroughly investigated prior to the construction in order to insure that the funds invested will not be wasted and that the total environment as well as water quality in Lake Superior will be protected.

I realize that this approach will be unpopular among some conservation groups and some political candidates. However, if technical information is to play a sensible role in decisions of this type, people of Minnesota, Michigan and Wisconsin, as well as the nation, and Reserve Mining Company have the right to demand that any decision be scientifically sound.

The Chairman of the August 12-13 Conference inquired about my qualifications to speak on the biological aspects of taconite tailings on water quality. For this reason, I am submitting for the record a resume (updated since the first Conference) of my background and experience. In addition, my formal education at San Jose State, the University of North Carolina School of Public Health, and Harvard University included extensive biological science work--six courses in bacteriology and microbiology. This was one of my PhD. minor areas* at Harvard University. Another PhD. minor area* at Harvard was limnology-hydrobiology.

The current position which I have held for the past nine years is Professor of Water Chemistry and Director of the University of Wisconsin Water Chemistry Program. I feel it is important for the Conferees to understand that water chemistry at the University of Wisconsin is not limited to training students for the normal chemist's role in the water pollution field of chemical analysis. In addition to chemical analysis and other chemical aspects, a student graduating with a PhD. at the University of Wisconsin has had courses in microbiology, hydrobiology, limnology, oceanography and sanitary engineering. The University of Wisconsin water chemistry program was designed to train students (currently 30 graduate students are enrolled) for research careers in the sources, modes of transport, chemical-biochemical activity (chemical forms and transformations) and the significance of chemical pollutants in natural waters. Work in this area cannot be conducted without extensive study of the biological aspects of natural waters. In fact, the role of micro-organisms in the chemistry of natural water is one of the primary areas of study at the University of Wisconsin water chemistry program. My work in this area is documented in the attached resume and the number of MS and PhD. theses as well as publications in the technical literature.

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* A PhD. minor area means that the student takes a selected sequence of courses in the topic area as part of the requirements for fulfillment of his degree.

Eutrophication of natural waters has been one of my major research areas for the past ten years. I was conducting research in the area when the FWQA and its predecessor organizations in the mid-1960's held the view that there was no need to conduct additional research on the eutrophication of Lake Mendota since the lake had already been studied extensively--the reason given for rejecting support of a research proposal that I submitted to the FWQA predecessor organization. It is interesting to note that in 1970 the FWQA is providing to the University of Wisconsin in excess of a quarter of a million dollars per year for eutrophication research, the majority of which is being used to study various aspects of this process in Lake Mendota. It is also interesting to note that the majority of the funds are devoted to water chemistry aspects of eutrophication such as nutrients sources, availability and reactivity.

The resume summarizes my work in this area. Some of my most recent activities in the areas of eutrophication include being an invited panel member and panel chairman of FWQA workshops on systems modeling and eutrophication and methods for lake rehabilitation. I have served as an advisor to the President's Council on Environmental Quality, the Office of Science and Technology and the Canadian Government on eutrophication of natural waters. Also, I have recently completed a comprehensive review of the factors influencing the exchange of chemicals from lake sediments to water with emphasis on aquatic plant nutrients and on the eutrophication of natural waters. Both of these reviews will be published by the National Eutrophication Center established at the University of Wisconsin which is supported in part by the Federal Water Quality Administration.

My experience in the area of the factors affecting algal stimulation may be judged by my previous publications in this area as listed in my resume, as well as my current research. For example, I have just had a student complete a PhD. thesis on the forms of phosphorus available to algae in natural waters. Possibly the best way to demonstrate my experience in this area is to point out that recently the Acting Director, Division of Water Quality Research of the Federal Water Quality Administration has requested that I provide a critical evaluation of a study conducted by FWQA scientists on the factors affecting the growth of algae under laboratory and field conditions.

I feel confident that I am qualified to comment on the biological aspects of the discharge of taconite tailings on water quality in Lake Superior and I feel qualified to discuss the potential effects of taconite tailings on the eutrophication of Lake Superior.

The comments I have presented on the quality of the various studies of the effects of taconite tailings on water quality in Lake Superior have not been restricted to my own views. In addition, they represent critical reviews of several University of Wisconsin faculty and staff who are recognized experts in various topic areas covered by my report. For example, Dr. R. Gerhold of the University of Wisconsin, Water Resources Center, holds a PhD. degree from Ohio State in Bacteriology. He has had extensive industrial experience in the area of the availability of nutrients to algae. Currently, he is one of the primary individuals developing the FWQA-sponsored program of the Provisional Algal Assay Procedure, or PAAP test. At my request, Dr. Gerhold and other University of Wisconsin staff, have made detailed reviews of the various FWQA Duluth Laboratory studies presented at the April, 1970, Conference, as well as Dr. Goldman's and Dr. Shapiro's studies on algal stimulation by taconite tailings. Upon request, copies of Dr. Gerhold's reports, as well as those of others, can be supplied to the Conferees. They show that the majority of the studies conducted by the FWQA Duluth Laboratory and Dr. Goldman and Dr. Shapiro do not have sufficient statistical reliability to warrant any conclusion that taconite tailings stimulate the growth of algae--even under laboratory conditions, much less in Lake Superior. They also show that if the studies were valid, they along with bacterial stimulation studies could completely invalidate the applicability of the results to Lake Superior. Certainly, additional studies will be needed to show that the experimental conditions used did not bias the results. Since the transcript of the Two Harbors trial has been made a part of the record of this Conference by the State of Minnesota, I urge that if the Conferees have any doubt about the validity of my statements on the quality of work in the area of algal stimulation, they examine the transcript of this trial. Many of the problems and shortcomings of these studies were brought out under cross examination of the various witnesses who presented them.

I would be happy to meet with the Conferees at their convenience and discuss any aspect of my testimony with regard to the effect of taconite tailings on water quality in Lake Superior. I sincerely regret that I have been placed in a position of having to criticize some of the work by Dr. Donald Mount, Director of the National Water Quality Laboratory, Duluth, on the effect of taconite tailings on water quality. He is one of the most talented individuals in the world in the area of toxicity of chemicals to aquatic organisms. My criticism of the work on algal and bacterial stimulation produced by Dr. Mount's staff should not be interpreted to mean that I am critical of all the work of that Laboratory. In defense of Dr. Mount, I wish to point out that he has had to operate under budget and staff limitations in his studies on taconite tailings in the area of algal stimulation, and I believe he did not receive the support he requested from other parts of the FWQA. As a result, Dr. Mount has had to have the algal stimulation studies conducted by members of his staff who have had little experience in the area of algal nutrition and eutrophication.

It is clear from studies conducted thus far that the detection of any deleterious effect of taconite tailings on water quality will require very carefully planned and executed laboratory and field studies. It is also clear that even after extensive study, no deleterious effects have been found thus far, except for the occasional appearance of "green water" in the region of Silver Bay. In addition, the statement by Dr. Mount that the key effect from the discharge of taconite tailings on water quality is the eutrophication of Lake Superior is simply not supported by the data available. Therefore, in my opinion, there is no technical basis to support a conclusion that the discharge of taconite tailings to Lake Superior constitutes any interstate pollution because of accelerated eutrophication of the lake.

At the close of my presentation to the Conferees, the Chairman stated that he did not hear anything new over what I had said at the first session of the Conference. I suggest that if the Conferees critically evaluate all of the data presented at the Lake Superior Enforcement Conferences, they will conclude that statements I made at the first session of the Conference are equally applicable today.

RESUME

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Home Address: 1140 Sherman Avenue
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Date and Place of Birth: July 27, 1933 Delano, California U. S. Citizen

Education:

B. S.	San Jose State College	1955
M. S.	University of North Carolina	1957
Ph.D.	Harvard University (Division of Engineering and Applied Physics)	1960

Experience:

Assistant Professor of Water Chemistry, University of Pittsburgh	1960-61
Assistant Professor of Water Chemistry, University of Wisconsin	1961-63
Associate Professor of Water Chemistry, University of Wisconsin	1963-65
Professor of Water Chemistry, University of Wisconsin	1965-Present

Health: Good **Marital Status:** Married **Military Service:** None

Honors: Sigma Xi, Delta Omega, Phi Lambda Upsilon

Memberships and Other Activities:

Vice Chairman - Lake Mendota Problems Committee, City of Madison, Wisconsin 1964 to present

Secretary - Technical Advisory Council of the Pesticide Review Board for the State of Wisconsin

Advisor - Governor's Technical Committee on Project Sanguine Effects on Environment

Member - American Water Works Association Committees on Organic Contaminants in Water, Iron and Manganese, Chlorine, Nutrients in Water, and Quality Control in Reservoirs

Water Pollution Control Federation Committees on Biodegradation and Nitrogen-Phosphorus

American Society for Testing Materials Committee on Organics in Water

Member - Water Subcommittee on Excessive Fertilization, Wisconsin Natural Resources Committee of State Agencies

Editorial Advisory Board, Environmental Science & Technology, published by American Chemical Society (1966-68)

Steering Committee, International Biological Program Study on Lake Wingra Project on the Analysis of Ecosystems. Section Leader on Aquatic Nutrient Systems Modeling

U. S. Public Health Service Drink Water Standards Committee

Steering Committee for Chemical and Biological Studies on Lake Ontario as part of the International Field Year for Great Lakes Research

Wisconsin Academy of Science, Arts & Letters, American Agronomy Society, American Chemical Society, American Ecological Society, American Geochemical Society, American Society for Limnology & Oceanography, American Water Works Association, Delta Omega, International Association for Ecology, International Association of Geochemistry and Cosmochemistry, International Association for Great Lakes Research, Midwest Benthological Society, Sigma Xi, Societas Internationalie Limnologiae, Soil Science Society of America, and Water Pollution Control Federation

University of Wisconsin Student Conduct Hearings Committee, 1969

University of Wisconsin Faculty Campus Planning Advisory Committee

University of Wisconsin Executive Committee, Physical Sciences Division

University of Wisconsin Graduate School Fellowships Committee, Physical Sciences Division

Detergent Advisory Committee, Wisconsin State Board of Health

Chairman -University of Wisconsin College of Engineering Committee on Chemistry for Engineers

Faculty Advisor -Phi Lambda Upsilon (Honorary Scholastic Chemical Society)

EXAMPLES OF
CONSULTING ACTIVITIES

Firm or Agency	Type of Activity
Reserve Mining Company	Advise on analytical methods, sampling program and procedures for the study on the effect of taconite tailings on water quality. Testified at FWPCA Lake Superior Enforcement Conference.
Martin Marietta Corporation	Evaluation of new waste treatment procedure for control of environmental pollution.
Boyle & Polkowski Engineers	Advise on chemical methods for treatment of municipal and industrial waste waters.
Banister Engineers	Review potential water quality in lakes located near Albert Lea, Minnesota, as a result of phosphate removal from waste waters.
Proctor & Gamble Company	Review current U. W. work on exchange of phosphate from lake sediments and advise on analytical methods for the study of phosphate chemistry.
Lake County, Illinois Department of Health	Advise on control of excessive lake fertilization problems. Establish a study program to evaluate origin of problems.
Federal Water Pollution Control Administration	Review of analytical method and data on water quality in Great Lakes (1964-1967).
	Panel member in workshop on systems modeling of eutrophication.
	Panel section leader on chemical methods for lake rehabilitation.
Madison Public Library and U. S. Biotron	Recommend methods for the water treatment in cooling towers.
Beling Engineering	Recommend procedures for boiler water treatment.
Calgon, Inc.	Advise on new methods for waste treatment.
USDA Soil Conservation Service	Advise on proposal for evaluation of the cause of water quality problems in Little St. Germain Lake.
Bettis Atomic Power Laboratory	Conduct environmental sampling and monitoring program for radioactivity.

EXAMPLES OF CONSULTING ACTIVITIES (cont.)

Firm or Agency	Type of Activity
Automated Environmental Systems	Advise on potential market for new automated instrumentation for water pollution control.
	Advise on water quality control systems for long period manned space flights.
John Bowers, Attorney	Assist in preparation of legal action to bring about termination of environmental pollution by industrial firms (milk processing wastes).
Culligan Water Conditioning	Evaluation of cause of hot water heater failure.
Geonautics, Inc.	Assist in developing systems model proposal for Great Lakes.
Homeowners Association and City of South Tahoe, California	Evaluate proposed water quality improvement method for Tahoe Keyes.
Carus Chemical Company	Advise on evaluation and use of $KMnO_4$ for algae control.
Bio-Test Industrial Laboratories	Advise on a field and laboratory study program to evaluate the effect of thermal pollution on water quality.
Attorney General, State of Illinois	Assist in the preparation of lawsuit against U. S. Steel Corporation on the effects of the discharge of their waste waters on water quality in southern Lake Michigan.
Jamieson Engineering	Develop system for improved water quality in Boscobel municipal water system (iron, sulfide problems). Evaluate performance of Boscobel waste water treatment plant. Evaluate potential for ridge and furrow irrigation as a method of waste water disposal for creamery.
U. W. Cooperative Extension Program	Advise on disposal of pesticides and pesticide containers.
Menasha Industries	Advise on acquisition of a consulting firm in water pollution area.
James McHugh Construction	Advise on potential water quality in a lake with regard to purchase of property.
Wisconsin Department of Natural Resources	Advise on use of pesticides for fish management programs.

EXAMPLES OF
CONSULTING ACTIVITIES (cont.)

Firm or Agency	Type of Activity
Limnetics, Inc.	Advise on development of water quality monitoring equipment. Evaluate potential water quality in proposed impoundment. Advise on demonstration grant application for advanced waste water treat ment.
Federal Water Pollution Control Administration	Participate in meeting on the sources and significance of polychlorobiphenyl compounds in the aquatic environment.
President's Council on Environmental Quality	Participate in meetings on the role of phosphate in the eutrophication of natural waters.

PUBLICATIONS

1. Granstrom, M. L. and Lee, G. F. "Rate and Mechanisms of Reactions Involving Oxychloro Compounds" Public Works 88 90-2 (1957)

2. Granstrom, M. L. and Lee, G. F. "Generation and Use of Chlorine Dioxide in Water Treatment" J. AWWA 50 1453-66 (1958).

3. Lee. G. F. and Stumm, W. "Determination of Ferrous Iron in the Presence of Ferric Iron with Bathophenanthroline" J. AWWA 52 1567-73 (1960).

4. Stumm, W. and Lee, G. F. "The Chemistry of Aqueous Iron" Schweizerische Zeitschrift für Hydrology XXI 295-319 (1960).

5. Stumm, W. and Lee, G. F. "Oxygenation of Ferrous Iron" Ind. Eng. Chem. 53 143-6 (1961).

6. Lee, G. F. and Morris, J. C. "Kinetics of Chlorination of Phenol-Chlorophenolic Tastes and Odors" Int. J. Air & Water Poll. 6 419-31 (1962).

7. Middleton, F. M., Greenberg, A. E. and Lee, G. F. "Tentative Method for Carbon Chloroform Extract (CCE) in Water" J. AWWA 54 223-7 (1962).

8. Lee, G. F. "Studies on the Iron, Manganese, Sulfate, and Silica Balances and Distributions for Lake Mendota, Madison, Wisconsin" Trans. Wisconsin Acad. Science, Arts & Letters LI 141-155 (1962).

9. Lee, G. F. (ed) "Water Chemistry Studies on Black Earth and Six Mile Creeks" University of Wisconsin, 1963-64 (mimeo).

10. Shearer, S. D. and Lee, G. F. "Leachability of Radium-226 from Uranium Mill Solids and River Sediments" Health Physics 10 217-227 (1964).

11. Rai, H. and Lee, G. F. "Separation of Planktonic Algal Pigments by Thin Layer Chromatography" Anal. Chem. 36 2208 (1964).

12. Lee, G. F. discussion of paper "Role of Multivalent Hydrous Metal Oxides on Limnological Transformation" by J. Morgan and W. Stumm, Proc. 2nd Int. Conf. Water Pollution Research, Tokyo, August, 1964, Pergamon Press, 1965.

13. Kobayashi, S. and Lee, G. F. "Freeze Concentration of Dilute Aqueous Solutions" Anal. Chem. 36 2197 (1964).

14. Clesceri, N. L. and Lee, G. F. "Thin Layer Chromatographic Separation of Orthophosphate and Pyrophosphate" Anal. Chem. 36 2207 (1964).

15. Malhotra, S. K., Lee, G. F. and Rohlich, G. A. "Nutrient Removal from Secondary Effluent by Alum Flocculation and Lime Precipitation" J. Air Water Poll. 8 487-500 (1964).

PUBLICATIONS (cont.)

16. Lee, G. F. (ed.) "Great Lakes Research" Proceedings of Water Chemistry Seminar, University of Wisconsin, 1964-65 (mimeo).

17. Lee, G. F. (ed.) "Eutrophication of Natural Waters" Proceedings of Water Chemistry Seminar, University of Wisconsin, 1964-65 (mimeo).

18. Lee, G. F. "Eutrophication of Natural Water" Seminar, Geography Panel Committee on Pollution, National Academy of Science-National Research Council, Washington, D. C., March, 1965.

19. Lee, G. F., Kumke, G. W. and Becker, S. L. "Recovery of Organics from a Eutrophic Lake by the Carbon Adsorption Technique" J. Air Water Poll. 9 69-80 (1965).

20. Lee, G. F. and Harlin, C. C. "Effect of Intake Location on Water Quality" Ind. Water Eng. 2 36-40 (1965).

21. Gardner, W. S. and Lee, G. F. "Oxygenation of Lake Sediments" J. Air Water Poll. 9 553-564 (1965).

22. Clesceri, N. L. and Lee, G. F. "Hydrolysis of Condensed Phosphates. I: Non-Sterile Environment" J. Air Water Poll. 9 723-742 (1965).

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25. Lee, G. F., Chairman "Report on the Nutrient Sources of Lake Mendota" Nutrient Sources Subcommittee of the Lake Mendota Problems Committee, 37 pp. (January 1966) (mimeo).

26. Lee, G. F. and Fruh, E. G. "The Aging of Lakes" Ind. Water Eng. 3, No. 2, 26-30 (1966).

27. Lee, G. F. (ed.) "Organics in Natural Waters" Proceedings of Water Chemistry Seminar, University of Wisconsin, 1965-66 (mimeo).

28. Lee, G. F. "Automatic Methods for the Analysis of Natural Waters" Proc. IBP Symposium, Nieuwersluis, In Chemical Environment in the Aquatic Habitat, pp. 169-180 (1966).

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34. Fruh, E. G., Stewart, K. M., Lee, G. F. and Rohlich, G. A. "Measurement of Eutrophication and trends" J. WPCF 38 1237-1258 (1966)

35. Lee, G. F. "Chemical Transformations in Self-Purification" National Symposium on Water Quality Standards for Natural Water, Univ. of Michigan, 251-256 (1966).

36. Lee, G. F. "Kinetics of Reactions Between Chlorine and Phenolic Compounds" in Principles and Applications of Water Chemistry, Faust, S. D. and Hunter, J. V. (Eds.), pg. 54-74, Wiley, 1967.

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40. Lee, G. F. and Hoadley, A. F. "Biological Activity in Relation to the Chemical Equilibrium Composition of Natural Water" in Equilibrium Concepts in Natural Water Systems, Gould, R. R. (ed.), Advances in Chemistry Series No. 67, Amer. Chem. Soc., pg. 319-338 (1967).

41. Gjessing, E. and Lee, G. F. "Fractionation of Organic Matter in Natural Waters on Sephadex Columns" Environ. Sci. & Tech. 1 631-638 (1967).

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43. Lee, G. F. (ed.) "Data on Lake Mendota and Other Wisconsin Lakes" June, 1965 to July, 1967 (mimeo).

44. Lee, G. F. (ed.) "Water Chemistry of Radionuclides and Radioactive Wastes Proceedings of Water Chemistry Seminar, University of Wisconsin, 1967-68 (mimeo).

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47. Spear, R. D. and Lee, G. F. "Glycolic Acid in Natural Waters and Laboratory Cultures" Environ. Sci. & Tech. 2 557-58 (1968).

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50. Delfino, J. J. and Lee, G. F. "Chemistry of Manganese in Lake Mendota, Wisconsin" Environ. Sci. & Tech. 2 1094-1100 (1968).

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57. Delfino, J. J., Bortleson, G. C. and Lee, G. F. "Distribution of Mn, Fe, P, Mg, K, Na and Ca in the Surface Sediments of Lake Mendota, Wisconsin" Environ. Sci. & Tech. 3 1189-92 (1969).

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59. Lee, G. F. "Analytical Chemistry of Plant Nutrients" Proceedings of Symposium on Eutrophication, Madison, Wisconsin, National Academy of Sci. 646-658 (1969). Also published in Water & Sewage Works Reference Number R-38-43 (1969).

60. Lee, G. F. and Wilson, W. H. "Use of Chemical Composition of Fresh Water Clamshells as Indicators of Paleohydrologic Conditions" Ecology 50 990-997 (1969).

61. Hall, K. J., Weimer, W. C., and Lee, G. F., "Amino Acids in an Estuarine Environment", Limnology and Oceanography 15 162-164 (1970).

62. Lee, G. F. "Control of Aquatic Plant Nutrients" Wisconsin Academy Review 16 41 (1970).

In addition, G. Fred Lee was a member of committees that prepared the following publications:

"Nutrients Associated Problems in Water Quality and Treatment" Report to AWWA Task Group on Nutrients in Water, J. AWWA 58 1337-55 (1966).

"Sources of Nitrogen and Phsophorus in Water Supplies" Report by AWWA Task Group on Nutrients in Water, J. AWWA 59 344-66 (1967).

"Excessive Water Fertilization" Report to Wisconsin Water Subcommittee, Natural Resources Committee of State Agencies (1967) mimeo.

"Required Characteristics and Measurement of Biodegradability" Report to Water Pollution Control Federation Subcommittee on Biodegradability (to be published in 1970).

"Chemistry of Nitrogen and Phosphorus in Natural Waters" AWWA Task Group on Nutrients in Water, J. AWWA 62 127-140 (1970).

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Amundson, R. and Lee, G. F. "Leaching of Nutrients from Marsh Sediments" (submitted for publication).

Armstrong, D. E., Spyridakis, D. E. and Lee, G. F. "Cycling of Nitrogen and Phosphorus in Natural Waters with Particular Reference to the Great Lakes" presented at American Chemical Society meeting, Minneapolis, Minnesota, April, 1969 (accepted for publication).

Bentley, E. M., Lee, G. F. and Spyridakis, D. E. "Effect of Marshes on Water Quality" (submitted for publication).

Bentley, E. M., Lee, G. F. and Spyridakis, D. E. "Chemical Characterization of Marsh Discharge Water (submitted for publication).

Bentley, E. M., Lee, G. F. and Spyridakis, D. E. "Water Quality of Drained Marsh Discharge Water" (submitted for publication).

Bortleson, G. C. and Lee, G. F. "Chemistry of Lake Sediment Cores" (submitted for publication).

Boucher, F. R. and Lee, G. F. "The Adsorption of Chlorinated Hydrocarbon Pesticides on an Unconsolidated Aquifer Sand" (submitted for publication).

Delfino, J. J. and Lee, G. F. "Release of Manganese from Lake Mendota Sediments" (submitted for publication).

Doll, F. L. and Lee, G. F. "Effect of Coagulants on Lime-Soda Softening of Water" (submitted for publication).

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Hall, K. J., Weimer, W. C. and Lee, G. F. "Amino Acids in an Estuarine Environment" (accepted for publication).

Hanson, A. and Lee, G. F. "Studies on the Forms of Organic Nitrogen in Domestic Waste Waters" (submitted for publication).

Hughes, R. A., Veith, G. D. and Lee, G. F. "Analysis of Toxaphene in Lake Water, Sediments, Plankton and Fish" Presented at Applied Spectroscopy Society meeting, Chicago, Illinois, May, 1969 (submitted for publication).

Kluesener, J. W. and Lee, G. F. "Deoxygenation of Petenwell Reservoir on the Wisconsin River" (in preparation).

PUBLICATIONS IN PRESS AND PREPARATION (cont.)

Lee, G. F. "Eutrophication" (submitted for publication in Encyclopedia of Chemical Technology, Wiley).

Lee, G. F. "Studies on the Aqueous Environmental Chemistry of Phosphorus in Lower Green Bay" Presented at the American Chemical Society meeting, Houston, Texas, February, 1970.

Lee, G. F. "The Role of Man in Influencing the Flux of Nitrogen and Phosphorus to Surface Waters" To be presented at the International Association of Geochemistry and Cosmochemistry, Tokyo, Japan, September, 1970.

Lee, G. F. "Factors Affecting the Exchange of Materials from Lake Waters and Sediments" Presented at American Chemical Society meeting, New York, September, 1969 (accepted for publication).

Lee, G. F. and Wilson, W. H. "Studies on the Ca, Mn and Na of Fresh Water Clamshells" (submitted for publication).

Morton, S. D. and Lee, G. F. "Studies on Magnesium Carbonate Ion Pair" (in preparation).

Peterson, J. O. and Lee, G. F. "Sorption Capacity Estimation for Activated Carbon Packed Columns" (submitted for publication).

Rai, H., Lee, G. F. and Fruh, E. G. "Plankton of the Madison Lakes" (in preparation).

Sonzogni, W. C. and Lee, G. F. "Productivity and Chemical Characteristics of Some Small Ponds" (submitted for publication).

Sridharan, N. and Lee, G. F. "Coprecipitation of Organics from Lake Water by Iron" (submitted for publication).

Veith, G. D. and Lee, G. F. "Water Chemistry of Toxaphene--Role of Lake Sediments" (submitted for publication).

Wang, W., Spyridakis, D. E. and Lee, G. F. "Sorption of Parathion and DDT on Montmorillonite and Lake Sediments" (submitted for publication).

Weimer, W. C. and Lee, G. F. "Origin of Meromixis in Lake Mary" (in preparation).

Wiersma, J. and Lee, G. F. "Aqueous Chemistry of Selenium" (in preparation).

WATER CHEMISTRY THESES

Completed under the supervision of G. Fred Lee

Author	Degree	Date	Title
Kobayaski, Shigeru	M. S.	1963	Freeze Concentration of Dilute Aqueous Solutions
Gardner, Wayne	M. S.	1964	Oxygenation of Lake Sediments
Brezonik, Patrick	M. S.	1965	Sources of Nitrogen Gas in Anaerobic Fermentation
Shannon, James	M. S.	1965	Hydrolysis Rates of Condensed Phosphates in Natural Waters
Johnson, W. DeWitt	M. S.	1965	Persistence of Toxaphene in Treated Lakes
Spear, Richard	M. S.	1965	Extracellular Glycolic Acid Accumulation in Natural Waters and Laboratory Cultures
Doll, Frederick	M. S.	1967	The Effect of Coagulants on the Lime-Soda Softening of Water
Bentley, Eugene	M. S.	1967	Determination of Calcium by Atomic Absorption Spectrophotometry
Peterson, James	M. S.	1967	Sorption of Rhodamine B on Activated Carbon
Kammerer, Phil	M. S.	1967	Freeze Concentration of Organic Compounds in Dilute Aqueous Solutions
Wentz, Dennis	M. S.	1967	Available Phosphorus in Lake Sediments
Hawley, John	M. S.	1967	Calcium Carbonate Equilibrium in Lake Mendota
Boucher, Frank	Ph. D.	1967	The Adsorption of Chlorinated Hydrocarbon Pesticides on an Unconsolidated Aquifer Substrate
Tranquillo, James	M. S.	1967	Concentration of Dilute Phenolic Solutions Utilizing DMSO

WATER CHEMISTRY THESES (cont.)

Author	Degree	Date	Title
Brezonik, Patrick	Ph. D.	1967	The Dynamics of the Nitrogen Cycle in Natural Waters
Bortleson, Gilbert	M. S.	1967	Chemistry of Lake Sediment Cores
Wang, Wun-Cheng	Ph. D.	1967	The Effect of the Association of Organic Material with Clays on Parathion and DDT Adsorption
Pfeil, Bernhard	M. S.	1967	Biodegradation of Nitrilotriacetic Acid
Delfino, Joseph	Ph. D.	1968	Aqueous Environmental Chemistry of Manganese
Hughes, Robert	M. S.	1968	Persistence of Toxaphene in Natural Waters
Plumb, Russell	M. S.	1968	The Iron-Organic Complex of Lake Mary
Veith, Gilman	M. S.	1968	The Role of Lake Sediments in the Water Chemistry of Toxaphene
Kluesener, John	M. S.	1968	Color and Oxygen Characteristics of Petenwell Flowage, Wisconsin River
Bentley, Eugene	Ph. D.	1969	The Effect of Marshes on Water Quality
Cowen, William	M. S.	1969	Construction of an Algal Turbidostat
Sonzogni, William	M. S.	1969	Productive Potential of Small Wisconsin Ponds
Valentine, Jane	M. S.	1969	Fate of Diquat in an Aquatic Environment
Hanson, Arthur	M. S.	1969	Organic Nitrogen Compounds in Domestic Waste Waters
Amundson, Rohel	M. S.	1970	Leaching of Nitrogen and Phosphorus from Marsh Sediments
Austin, Elizabeth	M. S.	1970	Release of Nitrogen from Lake Sediments
Torrey, Marguerite	M. S.	1970	Use of Algal Pigments to Estimate Eutrophication

WATER CHEMISTRY THESES (cont.)

Author	Degree	Date	Title
Weimer, Walter	M. S.	1970	The Origin of Meromixis in Lakes
Rodel, Max	M. S.	1970	Characterization of Odorous Compounds from Algae
Spear, Richard	Ph. D.	1970	Release of Phosphorus from Lake Sediments

Theses in progress under the supervision of G. Fred Lee

Author	Degree	Title
Bhatia, Rattan	M. S.	Effect of Sanitary Landfills on Water Quality
Bortleson, Gilbert	Ph. D.	Use of Lake Sediment Cores to Estimate Eutrophication
Cross, Charles	M. S.	Water Chemistry of Zinc
Cooper, Jon	Ph. D.	Studies on Chemical Factors Affecting Fish Homing
Donaldson, Donald	M. S.	Aqueous Environmental Chemistry of Boron
Erickson, Raymund	Ph. D.	Aqueous Environmental Chemistry of Mercury
Gardner, Wayne	Ph. D.	Aqueous Environmental Chemistry of Amino Aci and Proteins
Hall, Kenneth	Ph. D.	Characterization of Natural Water Organic Matt

Theses in progress under the supervision of G. Fred Lee (cont.)

Author	Degree	Title
Hughes, Robert	Ph. D.	Persistence of Toxaphene Isomers in Natural Waters
Kluesener, John	Ph. D.	Procedures for the Study of the Water Chemistry of Lakes with Emphasis on Systems Modeling
Kobayaski, Shigeru	Ph. D.	Aqueous Environmental Chemistry of Arsenic
Nienke, Gerald	Ph. D.	Aqueous Environmental Chemistry of Zinc in Lake Superior
Olson, Donald	M. S.	Effect of Mn Oxides and Sulfate on the Release of Phosphate from Lake Sediments
Peterson, James	Ph. D.	Aqueous Environmental Chemistry of Lead
Plumb, Russell	Ph. D.	Effects of Taconite Tailings on Water Quality
Sanchez, Isaac	Ph. D.	Aqueous Environmental Chemistry of Copper
Shannon, James	Ph. D.	Aqueous Environmental Chemistry of Sulfide
Shepherdson, John	M. S.	Effect of Impoundments on Water Quality
Sridharan, Nagalaxmi	Ph. D.	Aqueous Environmental Chemistry of Phosphorus in Lower Green Bay, Wisconsin
Stauffer, Robert	M. S.	Chemistry of Copper in Lake Superior
Thingvold, Daryle	Ph. D.	Persistence of TFM in Natural Waters
Torrey, Marguerite	Ph. D.	Studies on Algal Nutrition
Tranquillo, James	Ph. D.	Septic Tank System Waste Disposal as a Source of Phosphorus in Surface Waters
Veith, Gilman	Ph. D.	Persistence of PCB Compounds in Natural Waters
Walton, Craig	Ph. D.	Available Phosphorus in Natural Waters

SPEAKING ENGAGEMENTS AND SIMILAR ACTIVITIES

Lectured on Eutrophication of Natural Waters, Nutrient Sources and related topics at:

Canadian Center for Fisheries, Winnipeg, Canada
Georgia Institute of Technology

Montana State University

Regional Meeting, ACS, Appleton, Wisconsin
University of Michigan
University of Puerto Rico

Chicago Section, ACS

Manhattan College

National Academy of Science
Rice University

University of Minnesota
University of Wisconsin, Milwaukee

Cornell University

Midwest Regional Meeting, ACS, Kansas City
Northwestern University

Sanitary Engineering Conference, Madison, Wisconsin
University of Oklahoma

Lecture Topic	Location
Water Chemistry Education	AWWA Meeting -- Cleveland, Ohio
Chlorination of Phenol	ACS Meeting -- Atlantic City, N. J.
Chlorophonolic Tastes and Odors	Rudolph's Conference, Rutgers University
Factors Affecting the Exchange of Materials Between Sediments and Water	ACS Meeting -- New York, N. Y.
Water Chemistry in the Sea Grant Program at UW	ACS Meeting -- Houston, Texas
Role of Organisms in the Chemistry of Natural Waters	ACS Meeting -- Pittsburgh, Pennsylvania
Factors Affecting Exchange of Materials Between Sediments and Water	Clemson University
Invited Discusser -- Chemistry of Iron and Manganese in Natural Waters	Second International Conference on Water Pollution Research -- Tokyo, Japan
Invited Discusser -- ASCE Conference Effective Impoundments of Water Quality	Vanderbilt University and Portland, Oregon
Panel -- Water Quality Problems of the Great Lakes	Water Pollution Control Federation Meeting
Symposium Chairman, Chemical Limnology	Great Lakes Conferences, 1968 and 1970

Lecture Topic	Location
Invited Discusser -- Analytical Chemistry of Plant Nutrients	Gordon Conference on Water Quality
Invited Discusser -- Effective Organics in the Inorganic Composition of the Sea	Gordon Conference on Marine Chemistry
Organized ACS Symposia on Large Body Water Quality and Water Chemistry	ACS, New York ACS, Miami, Florida
The Role of Man in Increasing the Flux of Aquatic Plant Nutrients to Natural Waters	Minnesota Section ACS
Eutrophications -- Causes and Cures	Wisconsin Bureau of Weights and Measure

SUMMARY OF WATER CHEMISTRY PROGRAM

The Water Chemistry Program was initiated in 1962 as an interdepartmental graduate degree program designed to prepare students for careers in the chemical limnology, chemical oceanography, chemical hydrology, biogeochemistry and the chemistry of water supply, water and wastewater treatment and water pollution control. Currently, there are 30 graduate students enrolled in the program, 2 professorial staff, 1 teaching assistant, 1 project associate, and 5 other full-time personnel. The program currently has over 17,000 square feet of teaching and research facilities including a 30 ft. U. S. Naval launch outfitted as a laboratory, A U. S. Army amphibian Dukw used for coring, a panel truck outfitted as a portable laboratory and several other small boats and snowmobiles.

Courses Taught

Water Chemistry
Advanced Water Chemistry
Water Analysis
Advanced Techniques of Water Analysis
Radiochemistry
Colloid and Surface Chemistry
Marine Chemistry
Problems in Oceanography
Organic Water Chemistry
Aquatic Ecosystem Modeling

GRANTS AND AWARDS

G. Fred Lee, Principal Investigator:

Title	Source	Amount	Period
Water Chemistry Training Grant	FWQA	$ 425,000	1962-67
Water Chemistry Training Grant	FWQA	402,000	1967-72
Method of Concentrating Organic Solutes	FWQA	70,000	1964-67
Water Chemistry Research	U. W. Alumni Res. Foundation	18,500	1962-67
Eutrophication of Lakes	U. W. Water Resources Center	12,000	1965-68
Effect of Marshes on Water Quality	Wisconsin Conservation Div.	24,000	1967-69
Persistence of Toxaphene	Wisconsin Conservation Div.	24,000	1966-69
Use of Clamshells as Indicators of Paleohydrologic Conditions	NSF	30,000	1965-68
Contract for no-cost loan of 30 ft. Naval launch and U. S. Army amphibian Dukw	Office of Naval Research		1963-73
Use of Lake Sediment Cores to Estimate Eutrophication	FWQA	20,000	1969-70
Polychlorobiphenyl Compounds in Natural Waters and Fish	Wisconsin Conservation Div.	2,200	1969-70
Preliminary Studies on Systems Modeling of C N and P on Lake Wingra Basin	NSF	5,000	1969-70
Effect of Taconite Tailings on Water Quality	Reserve Mining Company	18,500	1969-70

In addition, G. Fred Lee has been sponsor for $325,000 of student research assistantships from federal agencies in the period 1963-70.

MR. STEIN: All right. We will proceed with presentations from the other States before we break for lunch. I think that is the view of the other conferees. After lunch we will have an executive session and then hopefully have an announcement.

May we call on Michigan. Mr. Purdy.

RALPH W. PURDY
EXECUTIVE SECRETARY
MICHIGAN WATER RESOURCES COMMISSION
LANSING, MICHIGAN

MR. PURDY: Yes, Mr. Stein. I would like to call on Mr. Courchaine to present the State's report.

But prior to his making the State's report I would like to bring to the attention of the chairman and the conferees some new legislation in Michigan that has been adopted by our legislature this year. One of the recommendations of the conferees related to boat pollution, and we have had in Michigan a regulation to control the discharges of human sewage from recreational pleasure craft. This regulation was challenged in court and the court upheld the regulation.

But in the meantime, our legislature has adopted a boat pollution bill. It is all inclusive. It includes the recreational craft and commercial craft, and further it makes it mandatory that marinas that provide services and that are upon the leased bottom lands of the State must also provide pumpout facilities. I know this now may well be an overlap on the Federal legislation, but this new State legislation takes effect January 1, 1971.

In addition to the boat pollution bill, Michigan legislature adopted legislation which now sets forth the right of an individual citizen to pursue action in the court to correct a pollution problem when they feel that they are aggrieved.

The third piece that has been passed by the legislature, but not yet signed by the Governor, was only passed the 7th of this month. It is one that the Governor supported, so I am reasonably sure that it will be signed. I think this is somewhat in the way of landmark legislation. It is known in Michigan as the truth-in-pollution bill, and in this one of the provisions makes it now mandatory that every person doing business within the State discharging wastewater to waters of the State or any sewer system which contains wastes in addition to sanitary sewage shall file annual reports with the Water Resources Commission setting forth the nature of their enterprise, a list of materials used in and incidental to its manufacturing processes, including byproducts and waste products which appear on a register of critical materials as compiled by the Commission, and in addition they must file an estimated annual total number of gallons of wastewater discharged. So that we will have now registration of materials used and waste products discharged and hopefully can prevent such problems as the mercury situation from developing in the future.

In addition to that, to provide additional surveillance now of industrial waste discharges, a surveillance fee will now be charged and any commercial enterprise or industry now discharging wastes into waters of the State, either directly or indirectly, must pay a surveillance fee and this fee will be based upon an administrative of $50, plus an additional fee set by the Water Resources Commission. And the additional fee shall be determined on a graduated basis using the volume of discharge to determine a base fee which then shall be multiplied by a factor dependent upon the strength of the organic and inorganic waste constituents to establish the

the total annual surveillance fee, and the maximum fee that can be assessed for any discharge that is in conformance with effluent restrictions shall not exceed $9,000 a year. This money now will be used to substantially strengthen the surveillance activities of the State, and we think this is somewhat landmark legislation.

Mr. Courchaine, will you present the State's report.

CLETUS COURCHAINE, SANITARY ENGINEER
MICHIGAN DEPARTMENT OF PUBLIC HEALTH
ESCANABA, MICHIGAN

MR. COURCHAINE: Yes, Mr. Purdy.

Mr. Chairman, conferees.

At the first session which began in Duluth, Minnesota, on May 13, 1969, a joint report was submitted on behalf of the Michigan Water Resources Commission and the Michigan Department of Public Health which outlined various State programs to abate pollution and enhance the quality of the waters of Lake Superior and its tributaries.

A report submitted on behalf of the Michigan

Water Resources Commission at the second session which began in Duluth, Minnesota, on April 29, 1970, described programs undertaken by Michigan to implement the State-oriented recommendations of the Secretary of the Department of the Interior stemming from the first session.

This report for the reconvened second session updates information presented in our April report.

Recommendation No. 1:

Required that a technical committee be formed to develop particular water quality criteria as guidelines for modification of the Federal-State water quality standards. A staff member of the Michigan Water Resources Commission assisted in preparation of the report which was presented to the conferees yesterday.

Recommendation 5:

Called for secondary biological waste treatment or its equivalent be provided by all municipalities discharging directly to or affecting Lake Superior or its bays or harbors or interstate tributary streams. This action is to be accomplished by January 1974.

Recommendation 8:

Waste treatment be provided by municipalities to achieve at least 80 percent reduction of total phosphorus by January 1975.

Recommendation 10:

Each State water pollution control agency make necessary corrections to the list in Appendix A of the Department of the Interior April 1969 report of the municipal and industrial waste discharges to the Lake Superior Basin and information be provided on each source to indicate whether it discharges pollutants, including nutrients, that have a deleterious effect on Lake Superior water quality. Detailed action plans for treatment of all wastes having deleterious effects should be developed where not already completed. Such plans shall identify the principal characteristics of the waste material now being discharged, the proposed program for construction or modification of remedial facilities and a timetable for accomplishment, giving target dates in detail.

The requirements of these three recommendations are contained in Appendix A and Appendix B of this revised report. Appendix A contains the Michigan's municipal surface water discharges in the Lake Superior Basin. This listing contains all of the communities in the Basin which have a discharge. A number of these communities are small communities which are only partially sewered, and a number of these are located inland, which affect intrastate waters but have not been found through water quality monitoring sampling by the Michigan Water Resources Commission to affect Lake Superior water quality.

Now, in April of this year we presented a list of those communities and industries affecting Lake Superior water quality. There was only one industry listed, and this is Hoerner-Waldorf, Inc., Ontonagon Mill Division. Treatment needs are secondary treatment. We have now received a stipulation from the company which will require implementation of the recommendations for secondary treatment for this discharge.

Those communities that were listed in which the Commission has not already initiated corrective programs enforcement proceedings are the White Pine and the Village of L'Anse. We have received now stipulations for correction of both of these problems.

The other communities requiring enforcement proceedings are the Village of Ontonagon, Ishpeming, Ishpeming Township, Marquette, Negaunee, Newberry, Hancock, Houghton, and Munising. The Michigan Water Resources Commission at its July meeting adopted notices of determination and hearing against these communities. These hearings in these cases are scheduled for the

August meeting of the Commission which will be held next week.

At each monthly meeting of the Water Resources Commission a report is presented which lists changes in the status of grant offers and developments since the previous month's meeting and summarizes all action to date. Appendix C is a copy of the report submitted at the July 1970 meeting and contains the type of information which is reported on monthly to our Commission.

(Which report follows:)

FOR THE RECONVENED CONFERENCE
THIRD SESSION
ON
POLLUTION OF THE INTERSTATE WATERS
OF
LAKE SUPERIOR AND ITS TRIBUTARY BASIN
(MINNESOTA - WISCONSIN - MICHIGAN)

CALLED BY
MURRAY STEIN, CONFERENCE CHAIRMAN
DEPARTMENT OF THE INTERIOR

STARTING AUGUST 12, 1970
DULUTH, MINNESOTA

ON BEHALF OF
THE
MICHIGAN WATER RESOURCES COMMISSION
DEPARTMENT OF NATURAL RESOURCES
AND
MICHIGAN DEPARTMENT OF PUBLIC HEALTH

AUGUST 1970

MICHIGAN WATER RESOURCES COMMISSION

John E. Vogt, Chairman, representing the Director, Michigan Department of Public Health

Stanley Quackenbush, Vice Chairman, representing the Director, Department of Agriculture

Gerald E. Eddy, representing the Director, Department of Natural Resources

John P. Woodford, representing the State Highway Commission

George F. Liddle, representing Municipal Groups

John H. Kitchel, representing Organized Conservation Groups

Alvin R. Balden, representing Industrial Management Groups

Ralph W. Purdy
Executive Secretary

Purpose

At the first session which began in Duluth, Minnesota on May 13, 1969, a joint report was submitted on behalf of the Michigan Water Resources Commission and the Michigan Department of Public Health which outlined various state programs to abate pollution and enhance the quality of the waters of Lake Superior and its tributaries.

A report submitted on behalf of the Michigan Water Resources Commission at the second session which began in Duluth, Minnesota on April 29, 1970 described programs undertaken by Michigan to implement the state-oriented recommendations of the Secretary of the Department of the Interior stemming from the first session.

This report to be presented at the third session will update information presented in the April 1970 report.

RECOMMENDATION 1

> A Technical Committee to evaluate water quality criteria for Lake Superior be formed of the conferees and such representatives as they may designate, within two weeks of the Executive Session. The purpose of the Committee is to develop particular water quality criteria as guidelines for modification of the Federal-State Water Quality Standards. The provision of the necessary secretarial assistance to the Committee will be the responsibility of the Federal conferee. The Committee may coordinate its activities with other committees or agencies, or engage consultants, as it determines appropriate. At the next session of the conference, the Committee will report to the conferees on recommendations agreed upon for changing or modifying existing water quality criteria to reflect desired quality conditions in Lake Superior.

The Technical Committee met once since the second session, on May 27, 1970. A staff member of the Michigan Water Resources Commission represented Michigan. The Committee revised the preliminary draft of "Water Quality Guidelines for Lake Superior". These revisions will be presented at the reconvened conference, third session.

RECOMMENDATION 5

> Secondary biological waste treatment or its equivalent be provided by all municipalities discharging directly to or affecting Lake Superior or its bays or harbors or interstate tributary streams. This action is to be accomplished by January 1974 or earlier if required by Federal-State Water Quality Standards.

RECOMMENDATION 8

> Waste treatment be provided by municipalities to achieve at least 80 percent reduction of total phosphorus from each State. This action is to be accomplished by January 1975 or earlier if required by Federal-State Water Quality Standards. At the next session of the conference, the conferees will present a detailed time schedule for their proposed programs.

RECOMMENDATION 10

> Each State water pollution control agency make necessary corrections to the list in Appendix A (U. S. Department of the Interior report "An Appraisal of Water Pollution in the Lake

> Superior Basin", April 1969) of municipal and industrial waste discharges to the Lake Superior Basin. In addition, information should be provided on each source to indicate whether it discharges pollutants, including nutrients, that have a deleterious effect on Lake Superior water quality. Detailed action plans for treatment of all wastes having deleterious effects should be developed where not already completed. Such plans shall identify the principal characteristics of the waste material now being discharged, the proposed program for construction or modification of remedial facilities, and a timetable for accomplishment, giving target dates in detail. This list shall be presented to the conferees at the next session of the conference.

Appendix A contains a revised list of municipal surface water discharges in the Michigan portion of the Lake Superior basin. This list includes information on time schedules for improvements in waste treatment required by the Michigan Water Resources Commission.

Appendix B contains similar information on industries which have surface water discharges in the Michigan portion of the Lake Superior basin.

Changes in Other Programs

Michigan's Clean Water Bond Program

At each monthly meeting of the Water Resources Commission, a report is presented which lists changes in the status of grant offers and developments since the previous month's meeting and summarizes all action to date. Appendix C is a copy of the report submitted at the July 1970 meeting.

APPENDIX A

MICHIGAN'S MUNICIPAL SURFACE WATER DISCHARGES IN THE LAKE SUPERIOR BASIN

MICHIGAN'S MUNICIPAL SURFACE WATER DISCHARGES IN THE LAKE SUPERIOR BASIN

Community	Receiving Waters	Treatment Provided	FOD or Stip.	Date Adopted or Revised	Retain Engineers	Submit Prelim. Engr. Report	Initiate Detailed Plans and Specs.	Submit Detailed Specs.	Arrange Financing	Initiate Const.	Complete Const.	Remarks
Discharge Directly to Lake Superior												
Baraga	Lake Superior	Primary ST	Stip. FOD	7-22-69 5-21-70		8-1-69		3-1-70 7-1-70		6-1-70 10-1-70	6-1-71 10-1-71	Village declared in default of Stip. 4-22-70. Final Order adopted
Montreal River Basin												
Erwin Township	Ground Waters	Secondary SF										See note 68
Ironwood	Montreal River	Secondary AS										Prelim. plans received for storm-water separation and phosphate removal 6-9-69
Ironwood Township	Welch Creek	Secondary TF										Prelim. plans for improved treatment received 5-5-69
Black River Basin												
Bessemer	Kallander Creek	Secondary TF	FOD	12-10-69		6-1-70		1-1-71		4-1-71	12-1-71	FOD adopted for improved secondary treatment and chlorination
Bessemer Township (Ramsay)	Black River	None	FOD	9-18-69				6-1-70		8-1-70	12-1-71	Prelim. plans for secondary treatment approved
Wakefield	Planter Creek	Secondary L										New plant operating satisfactorily
Presque Isle River Basin												
Marenisco	Presque Isle River	None										Engineers employed. Conference held 9-29-66, corrective program underway
Mineral River Basin												
White Pine	Mineral River	Secondary TF										Notified of need for phosphate removal. Stip. sent 6-10-70.
Ontonagon River Basin												
Bergland	Lake Gogebic	None										Prelim. plans for secondary treatment approved 2-30-70
Bruce Crossing	Clear Creek	None										Prelim. plans for secondary treatment approved
Ewen	S. Branch Ontonagon River	None										Prelim. plans received.
Ontonagon	Ontonagon River	Primary			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-74	Notice for secondary treatment and phosphate removal adopted 7-23-70
Rockland	Rockland Creek	None										Prelim. plans approved 2-30-70
Watersmeet	Middle Branch Ontonagon River	Primary IT										Current facilities satisfactory
Sleeping River Basin												
Mass-Greenland	Flintsteel River	None										Prelim. plans received
Portage Lake Basin												
Baltic	Branch Pilgrim River	Primary ST										See note 68
Copper City	Trap Rock River	Primary ST										See note 68
Florida	Hammell Creek	Connected to Laurium										
Laurium	Hammell Creek	Primary ST	FOD Ct. O	6-28-67				7-1-67	6-1-70	5-1-68 7-1-70	11-1-68 12-1-70	Current dates adopted by court decision
Plainesdale*	Ditches	None										See note 68
South Range	Branch Pilgrim River	Primary ST										See note 68
Portage Township	Huron Creek	None										See note 68

Community	Receiving Waters	Treatment Provided	FOD or Stip.	Date Adopted or Revised	Retain Engineers	Submit Prelim. Engr. Report	Initiate Detailed Plans and Specs.	Submit Detailed Specs.	Arrange Financing	Initiate Const.	Complete Const.	Remarks
Carp River Basin												
Ishpeming	Carp River	Primary			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-75	Notice for phosphate removal adopted 7-23-70
Ishpeming Township A	Carp River	Primary IT			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-75	Notice for phosphate removal adopted 7-23-70
Ishpeming Township B	Carp River	Primary IT			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-75	Notice for phosphate removal adopted 7-23-70
Marquette	Carp River	Primary			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-74	Notice for secondary treatment and phosphate removal adopted 7-23-70
Negaunee	Ditch	Secondary TF			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-75	Notice for phosphate removal adopted 7-23-70
AuTrain River Basin												
Chatham	Slapneck Creek	None										Engineers employed. Conference held 9-30-66, corrective program underway
Tahquamenon River Basin												
Newberry	Tahquamenon River	Primary			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-75	Notice for phosphate removal adopted 7-23-70
Miscellaneous												
Ahmeek	Hills Creek	None										Prelim. engineering report for secondary treatment approved
Allouez	Hills Creek	None										Conference held 9-30-66, corrective program underway
Big Bay	Lake Independence	Primary ST										Engineers employed for proposed stabilization lagoons
Calumet	Ground Waters	Secondary SL										Served by Northern Michigan Water Company
Gay	Tobacco River	Primary ST										See note 6B
Hancock	Portage Lake	Secondary AS			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-75	Notice for phosphate removal adopted 7-23-70
Houghton	Portage Lake	Secondary AS			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-75	Notice for phosphate removal adopted 7-23-70
Hubbell	Torch Lake	None										Engineers employed
Lake Linden	Torch Lake	None										Engineers employed. Conference held 9-30-66, corrective program underway
L'Anse	Linden Creek	Secondary AS			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-75	Notice for phosphate removal adopted 7-23-70
Mohawk	Hills Creek	None										Prelim. plans received
Munising	Anna River	Primary			12-1-70	9-1-71	11-1-71	6-1-72	9-1-72	10-1-72	1-1-74	Notice for secondary treatment and phosphate removal adopted 7-23-70

*Small amount discharged to Otter River - Sturgeon Basin

Note: AS - Activated Sludge
TF - Trickling Filter
SF - Sand Filter
L - Lagoons
SL - Seepage Lagoons
IT - Imhoff Tank
ST - Septic Tank
6B - Units have been notified that they are in violation of Section 6 B, Act 245; voluntary corrective action being sought
FOD - Final Order of Determination
OD - Order of Determination
Stip - Stipulation

APPENDIX B

MICHIGAN'S INDUSTRIAL SURFACE WATER DISCHARGES IN THE LAKE SUPERIOR BASIN

MICHIGAN'S INDUSTRIAL SURFACE WATER DISCHARGES IN THE LAKE SUPERIOR BASIN

Company Name	Product	Location	Receiving Stream	Treatment Provided	1969* Waste-Water Control Status	Date of Order	Remarks
1. Montreal River Basin							
Superior Packing Company	Meat	Ironwood	Ground Waters	Septic tank and tile field	B	None	- -
2. Black River Basin							
- - - - - - - - - - - - - - - - No major industries in basin - - - - - - - - - - - - - - - -							
3. Presque Isle River Basin							
- - - - - - - - - - - - - - - - No major industries in basin - - - - - - - - - - - - - - - -							
4. Mineral River Basin							
White Pine Copper Company	Copper	White Pine	Native Creek and Mineral River	Chemical precipitation and settling	A	7-58	Control adequate
White Pine Copper Company, Tolfrey Shaft	Copper Ore	White Pine	Tolfrey and Argentine Creeks	Secondary treatment for sanitary sewage	A	10-66	Control adequate
5. Ontonagon River Basin							
Hoerner-Waldorf, Inc., Ontonagon Mill Division	Paper	Ontonagon	Ontonagon River	Save-all. Sanitary to City sewer	E	None	Stipulation adopted for secondary treatment 7-23-70. Start construction 8-1-72, complete by 1-1-74
Ontonagon Valley Co-op Creamery	Milk and Cheese	Bruce Crossing	Clear Creek	Haul whey away	B	None	- -
Tom Nordine Laundromat	Laundry	Bruce Crossing	Ground Waters	Lagoon	A	2-68	Control adequate
6. Sleeping River Basin							
Lake Superior Engineering, Inc.		Winona	Ground Waters	None	B	3-67	- -
7. Portage River Basin							
Bosch Brewing Company	Beer	Houghton	Portage Lake	Settling screens; sanitary - septic tank and tile field	B	None	- -
8. Sturgeon River Basin							
- - - - - - - - - - - - - - - - No major industries in basin - - - - - - - - - - - - - - - -							
9. Falls River Basin							
Celotex Corporation	Building Board	L'Anse	Ground Waters	Lagoon and spray irrigation	A	9-56	Control adequate
U.P. Power Company	Electricity	L'Anse	Falls River	Cooling water - none; ash disposal - none	A A	8-58	Control adequate for both
10. Dead River Basin							
Marquette Board of Power and Light, Diesel Plant	Electricity	Marquette	Dead River	None	E	9-67	Minor oil problem
Bancroft Dairy	Milk and dairy products	Marquette	Creek and Dead River	Septic tank	E	None	Will be joining municipal sewer system
11. Carp River Basin							
Cleveland Cliffs Iron Company (Ore Improvement Plant)	Iron Ore	Negaunee	Ground Waters	Settling ponds	A	5-57	Control adequate
Cleveland Cliffs Iron Company (Pioneer Pellet Plant)	Iron Ore Pellets	Negaunee	Ground Waters	Settling ponds	A	Same Order	Control adequate
Cleveland Cliffs Iron Company (Eagle Mills Pellet Plant)	Iron Ore Pellets	Negaunee	Ground Waters	Settling ponds	A	Same Order	Control adequate
Northern Automatic Electric Foundry	Iron Castings	Ishpeming	Ground Waters	Settling and cooling ponds	B	10-68	New pond
12. Chocolay River Basin							
James Sicotte Laundromat	Laundry	Harvey	Ground Waters	Lagoon	B	None	- -
13. AuTrain River Basin							
- - - - - - - - - - - - - - - - No major industries in basin - - - - - - - - - - - - - - - -							
14. Two-Hearted River Basin							
- - - - - - - - - - - - - - - - No major industries in basin - - - - - - - - - - - - - - - -							
15. Tahquamenon River Basin							
- - - - - - - - - - - - - - - - No major industries in basin - - - - - - - - - - - - - - - -							
16. Waiska River Basin							
- - - - - - - - - - - - - - - - No major industries in basin - - - - - - - - - - - - - - - -							

*Wastewater control status rated as of 1-1-70 for calendar year 1969.

NOTE: Industries discharging to ground waters will be deleted from subsequent lists.

APPENDIX C

CONSTRUCTION GRANT PROGRAM
STATUS OF GRANT OFFERS AND DEVELOPMENTS
SINCE THE JUNE 1970 MEETING

CONSTRUCTION GRANTS PROGRAM

STATUS OF GRANT OFFERS
&
DEVELOPMENTS SINCE JUNE MEETING

I. SEWAGE TREATMENT WORKS

- A. Projects From June 27, 1968 Priority List
  - 1. No change in status since June Meeting
- B. Projects Eligible For Additional Grant Funds (Construction commenced after June 30, 1967)
  - 1. No change in status since June Meeting
- C. Fiscal Year 1970 Program
  - 1. Certification of projects
    - a. Since the June Meeting the following 19 projects have been certified to the FWQA:

1. Lenawee County (Onsted)
2. Monroe County (Carleton)
3. Monroe County (Berlin Twp.)
4. Mayville
5. Fowler
6. Charlevoix
7. Eaton County (Sunfield)
8. Clinton County (Westphalia)
9. Berrien County (Coloma-Watervliet)
10. Manton
11. Deckerville
12. Wayne County (Trenton Plant)
13. Clare County (Harrison)
14. Wayne County (Rockwood Plant)
15. Bay County (Linwood Area)
16. Saginaw County (Tittabawassee Twp.)
17. Centreville
18. Hastings
19. Huron County (Sebewaing)

    - b. To date, 78 projects have been certified
  - 2. Offers of grants and advances
    - a. Since the June Meeting, offers of grants and advances have been made as follows:

1.	City of Laingsburg	$ 130,000.00
2.	City of Escanaba	1,126,000.00
3.	Alpena County (Alpena)	1,207,500.00
4.	Jackson County (Parma)	76,500.00
5.	Kalamazoo County (Galesburg Interceptor)	1,192,500.00
6.	Village of Byron	67,250.00
7.	Bay County (Linwood Area)	57,500.00
8.	Kent County (Cedar Springs)	92,800.00
9.	Ottawa County Infirmary	18,960.00
10.	City of Rogers City	376,000.00
11.	City of Detroit	40,000,000.00
12.	Rollin-Woodstock San. Dist.	529,750.00
13.	City of Coldwater	702,500.00

    - b. To date, offers of State grants and advances totaling $53,944,690.00 have been made for 30 projects.
- D. Commitments From State Water Pollution Control Fund
  - 1. To date, commitments totaling $128,813,406.00 have been made for 112 projects.

E. Grant Payments From State Water Pollution Control Fund

1. Since the June Meeting, grant payments have been made to the following communities in the amounts indicated:

a.	City of Kalamazoo	$ 29,148.00 F*
b.	Village of Lakeview	8,621.00 F*
c.	Montcalm Community College	73,873.00 F*
d.	City of Sterling Heights	12,963.00 F*
e.	Village of Vernon	25,224.00 F*
f.	City of Carson City	40,406.00 F*
g.	Bay County (Essexville)	96,570.00
h.	Village of Brooklyn	37,779.00
		$324,584.00

*Final Payment

2. Total Grant Payments to date amount to $6,132,074.00.

II. COLLECTING SEWERS

Unchanged from June Meeting

MR. STEIN: Thank you.

Are there any comments or questions?

Again I would like to commend Michigan and its program, and particularly I would like to call the attention of the other States to the kind of reporting we are getting from Michigan. I am getting increasing demands from Washington, as Michigan knows from the other cases we have been in, to provide reporting in this fashion so everyone will know what is going on and will know if interim dates are missed. I would suggest that if the other States do not have a similar format that they may want to adopt this format.

I think the variety of questions we are getting now about 180-day notices, standards violations, Corps of Engineer permits, and so forth, can only be handled really by us in Washington when someone asks a question if we have this kind of detailed information. If we don't, sometimes a determination is going to be made which you think would not be appropriate, and I think if this kind of material we got from Michigan can be supplied to us, we would cut the misunderstandings down considerably.

Yes.

MR. MAYO: I have a question or two, Mr. Chairman.

In the listing on page 11, the discharge of the U. P. Power Company in the Falls River Basin is identified as being to the Falls River. In the earlier tabulation-- And it is cooling water and ash disposal and no treatment provided. In an earlier tabulation the discharge was indicated as being to Falls River and Lake Superior.

I would appreciate a little clarification of the difference in the identification at this time.

MR. COURCHAINE: I would like to call on our Upper Peninsula District Engineer to answer that, if he will, please.

MR. STEIN: Identify yourself by name.

MR. BAL: Joseph Bal, the District Engineer of Water Resources Commission. My territory covers the upper peninsula.

The U. P. Power Company discharges in the Falls River several hundred yards upstream from the mouth.

MR. MAYO: Do you have any information on the quantity of fly ash that is involved in the discharge, since it indicates that there is no treatment provided?

MR. BAL: The only discharge involving fly ash is some vacuum water. It is a dry process. The water is used to create the vacuum. It is not actually a wet process as we think of in terms of removing fly ash. It is a vacuum water that is discharged from the fly ash disposal.

MR. MAYO: In what volumes?

MR. BAL: I don't know, sir.

MR. STEIN: Any other comment?

MR. PURDY: I would like to ask one question.

Mr. Bal, does this water contain suspended solids, fly ash, in any great quantity?

MR. BAL: No, sir.

MR. MAYO: Do you have any idea what its chemical makeup is?

MR. BAL: We don't have an exact chemical composition.

MR. MAYO: We noticed also, Mr. Purdy, that Kimberly-Clark was not included in the current list and it was in the April 1970 list.

MR. PURDY: Kimberly-Clark should be. It is an oversight on our part.

MR. COURCHAINE: Kimberly-Clark, however, is not identified as a source affecting Lake Superior water quality.

MR. PURDY: We can furnish the supplemental information. I want that in.

(Supplemental information follows.)

MR. MAYO: All right.

MR. STEIN: Any other comments or questions?

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes.

MR. BADALICH: I hope you weren't inferring from your earlier remarks that the State of Minnesota was not submitting any--

MR. STEIN: No.

MR. BADALICH: --status reports, and so on, because we have done this at every conference.

MR. STEIN: No. And I want to make that clear. I looked at Wisconsin's. They are not in this format either.

MR. BADALICH: Ours are exactly in that format.

MR. STEIN: I am not inferring that at all. I think this is an additional added starter that I thought I indicated from people I report to in Washington. They ask certain questions, particularly about interim dates. I know the State has it.

STATE OF MICHIGAN

NATURAL RESOURCES COMMISSION
AUGUST SCHOLLE
Chairman
CARL T. JOHNSON
E. M. LAITALA
ROBERT C. McLAUGHLIN
HARRY H. WHITELEY

WILLIAM G. MILLIKEN, Governor

DEPARTMENT OF NATURAL RESOURCES
STEVENS T. MASON BUILDING, LANSING, MICHIGAN 48926
RALPH A. MAC MULLAN, Director

WATER RESOURCES COMMISSION
JOHN E. VOGT
Chairman
STANLEY QUACKENBUSH
Vice Chairman
GERALD E. EDDY
JOHN P. WOODFORD
JIM GILMORE
GEORGE F. LIDDLE
JOHN H. KITCHEL, M.D.

August 27, 1970

Mr. Murray Stein
Assistant Commissioner for
Enforcement
Federal Water Quality Administration
U. S. Department of the Interior
Washington, D.C.

Dear Mr. Stein:

As indicated at the re-convened second session of the Lake Superior Enforcement Conference held at Duluth, Minnesota on August 12-13, 1970, Michigan's report failed to list, in Appendix B, the Kimberly Clark Corporation waste discharge at Munising, Michigan.

The following should be added to Appendix B of your copy to correct this omission.

Company Name	Product	Location	Receiving Waters	1969 Waste Control Status	Date of Order	Remarks
Kimberly Clark Corp.	Paper products	Munising	Lake Superior	B	None	Control adequate

Very truly yours,

WATER RESOURCES COMMISSION

Ralph W Purdy
Ralph W. Purdy
Executive Secretary

RJC/sb
cc: Joe Bal
Gary Guenther
R. Courchaine

MICHIGAN
THE GREAT LAKE STATE

MR. BADALICH: Yes, we have those listed in our supplemental report.

MR. STEIN: I understand. Now, what I am saying is that I think we can get better communication in the questions that I am asked if I can supply these interim dates. I know you have them, and evidently the people there think they are important as to how to make certain decisions.

MR. BADALICH: O.K.

MR. STEIN: So I think since they are available we should just make them available so there will be no determination made just because of a lack of communication.

MR. BADALICH: O.K., I think we have an understanding.

MR. STEIN: This is not to criticize the reporting system at all.

MR. PURDY: Mr. Stein.

MR. STEIN: Yes.

MR. PURDY: I have two statements that I would like to place in the record, one by the Copper Country Chamber of Commerce, a resolution that they have adopted with respect to waste discharges into Lake Superior.

And the second is a statement that has been presented to me by Mrs. Verna Mize, Potomac, Maryland, former resident of the State of Michigan, and I believe that she is the housewife that you discussed earlier as having circulated the petitions and has received some 5,000 signatures protesting the discharge of wastes from Reserve Mining Company into Lake Superior. And I have copies of that I can furnish to the reporter.

MR. STEIN: All right. Without objection, these will be entered into the record as if read.

(Which statements follow:)

RECEIVED
AUG 6 11 [illegible] '70
EXECUTIVE OFFICE

CCC
COPPER COUNTRY CHAMBER OF COMMERCE Inc.
TEL. (906) 482-5240 • BOX 336 • COMMUNITY BUILDING • HOUGHTON, MICH. 49931

August 4, 1970

Governor William G. Milliken
State of Michigan
Executive Office
Lansing, Michigan 48924

Dear Governor Milliken:

On July 28, 1970 at a regular meeting of directors and members of our chamber of commerce, the following position was taken concerning the further deterioration of one of our areas most valued assets, namely Lake Superior.

That position is as follows:

BE IT RESOLVED that this Chamber is opposed to ALL pollution of Lake Superior from whatever source, ashore or afloat.

BE IT RESOLVED that we are opposed in particular to the degradation of Lake Superior caused by tailings emanating from Reserve Mining Company's taconite plant at Silver Bay, Minnesota.

A few of the reasons for such a position are:

Lake Superior is now one of the five Great Lakes left that is relatively free of pollution and deterioration, but unless sources of degradation are halted and controlled, it, too, may become another Lake Erie.

Thousands of visitors and summer residents come to this area each summer to enjoy the waters of Lake Superior. Many commenting on how enjoyable the lake is compared to the areas of Chicago, Gary, Indiana, Milwaukee, Detroit, and Buffalo, New York where they come from, and where even the fish are unfit to eat.

If too rigid controlls are enforced a loss of employment for one industry or a few, might be somewhat effected. But, if Lake Superior becomes a Lake Erie or a Lake Michigan; what becomes of the thousands employed in the tourist industry around Lake Superior who are now employed because Lake Superior still is relatively clean. What happens to the last remaining commercial fishermen? What happens to the sport and commercial fishing that the federal government, Canada and state governments are spending millions of dollars of taxpayers money to revive? What would happen to all of the thousands of summer homes, camps, parks and cottages that were built because Lake Superior is what it still is?

Total small business (fishermen, charter boat operators, owners of resort and tourist facilities) home owners, state and federal governments having park facilities have much at stake and must have help in protecting their investment and maintain employment by helping Lake Superior from further degradation.

Industry can survive, provide employment, and make profits without degrading our last relatively pollution free great body of fresh water. Many Michigan industries including iron mining companies are doing it today.

Pages could be written on examples of pollution, facts and testimony compiled pro and con on the subject of degradation of Lake Superior as already has been done, but some authority must ultimately enforce the laws that exist.

Therefore we urge you to take whatever action within your power at the Federal-State Enforcement Conference on Lake Superior, August 12-13, at Duluth, Minnesota, to see that the further degradation of Lake Superior is halted, and that proper enforceable measures are enacted to keep Lake Superior pollution free for future enjoyment and continued employment. With todays technology, we can have both, can't we?

Our chamber president, Robert (Bob) Haas, will be in attendance at the Duluth meeting.

Sincerely,

THE COPPER COUNTRY CHAMBER OF COMMERCE

Clyde A. Raasio
Manager-Secretary

CAR/rsc

SPECIAL

Please read before the Aug. 12, 1970 session of the Lake Superior Enforcement Conference in Duluth.

August 7, 1970

RECEIVED
AUG 10 1970
WATER RESOURCES COMMISSION

Mr. Ralph Purdy
Executive Secretary
Michigan Water Resources Commission
Mason Building
Lansing, Michigan 48926

Dear Mr. Purdy:

At the suggestion of Commissioner Laitala, I am writing to let you know of the deep concern for Lake Superior that thousands of Michigan citizens feel.

In the brief span of ten days, Mr. Purdy, five thousand people in the Keweenaw Peninsula signed a petition to President Nixon asking his personal intervention to stop the degradation of Lake Superior by the Reserve Mining Company's taconite plant at Silver Bay, Minnesota. Tourists from every part of Michigan and, indeed, from every corner of the nation were signatories. The petitions were circulated by children, teens, and adults to the age of 77! They were found in banks, loan companies, resorts, shops, restaurants, bars, gasoline stations and even in a Bible camp. The names of businessmen, laborers, college students, professors, housewives (like myself), lawyers, doctors, engineers, and practically every other walk of life are affixed to that petition! My own keen devotion to Lake Superior fanned a mighty "love-in" for the glorious Big Lake. It was a spontaneous community effort and response that surely must be evidence enough for Michigan officialdom to be convinced that the people CARE about the fate of Lake Superior.. We have more shoreline than the other two bordering states and, hence, more to lose by the degradation of Lake Superior.

It appears futile for the State of Michigan to expend funds to revitalize the commercial and sport fishing industries, when Reserve's tailings are reliably reported to be killing organisms on which fish feed, as well as being harmful to sac fry.

Another consideration is the fact that,by dumping at will into Lake Superior, Reserve gains an unfair advantage over Michigan plants in the marketplace. Free dumping into Lake Superior is an economy that Michigan industries do not enjoy--nor should they. Reserve must also be prohibited from doing so.

Minnesota people who have been fighting Reserve tell me they have had but little support from Michigan in this controversy--particularly at sessions of the Lake Superior Enforcement Conference. This conference will convene again on August 12. Lake Superior is in serious trouble and, now that the people know it, they will want their concern to be voiced. We hope you will find it possible to send to the conference a representative who will truly FIGHT for the Big Lake--somebody vocal and knowledgeable who will not be shouted down nor misled.

Admittedly, the company has ~~limitless~~ vast financial resources to fight for the privilege of dumping its tailings into the lake--but the State of Michigan and its citizens have rights which cannot be denied.

Please, Mr. Purdy, do not permit the coming session of the Lake Superior Enforcement Conference to deteriorate into another exercise in futility. The delaying tactics of Reserve must be halted. This wanton degradation of the last of the lakes entitled to the name "Great" MUST be stopped NOW. We dare not let it become "Lake Inferior" nor yet "Lake Mesabi."

Since you will wonder why an individual with a Maryland address is appealing to an official of the State of Michigan, I will tell you that I was born and reared in Michigan's Copper Country and still have a home there. That is truly my beloved homeland!

Mr. Purdy, please help us save our precious Gitche Gumee!

Sincerely,

Verna G. Mize

(Mrs.) Verna G. Mize
11200 River Road
Potomac, Maryland 20854

Enclosure - Petition to the President

cc: Commissioner Laitala

THE FATE OF LAKE SUPERIOR
IS NOT NEGOTIABLE!

Dear Mr. President:

We, the undersigned, respectfully and urgently request your speedy intervention to rescue Lake Superior from the ravages of taconite tailing degradation at Silver Bay, Minnesota, by the Reserve Mining Company. Pure Lake Superior is eminently worthy of your personal attention. We appreciate the concern for the Great Lakes you have already voiced, and we earnestly ask that you stop Reserve's use of clean Lake Superior for its own free private dump! Please, Mr. President, save "the clear transparent water . . . the shining Big Sea water" for us and for posterity.

NAME	ADDRESS
In a brief ten days in the Keweenaw Peninsula, 5000 people signed this petition. Persons from everywhere in Michigan and the nation thus evidenced their love and concern for Lake Superior.	
The fate of sublime Lake Superior is NOT negotiable.	
STOP RESERVE!	

MR. PURDY: I would like to inquire as to whether or not Mrs. Collins of the UAW is here and wishes to make a statement?

(No response.)

I have no other persons to call upon.

MR. STEIN: Thank you very much for Michigan's contribution.

May we call upon Wisconsin? Mr. Frangos.

THOMAS G. FRANGOS, ADMINISTRATOR
DIVISION OF ENVIRONMENTAL PROTECTION
WISCONSIN DEPARTMENT OF NATURAL RESOURCES
MADISON, WISCONSIN

MR. FRANGOS: Mr. Chairman, conferees.

Since the last session, last meeting of this enforcement conference, the Wisconsin legislature has not been in session. At that previous meeting in April we reported to you on a number of our programmed activities relating directly or indirectly to the Lake Superior conference. We do not have any other legislative changes to report to you since our legislature is not in session. Therefore, we have limited our report today to advising you of our maintenance schedules under the requirements of this conference.

Before getting into that, I would note that our department is seriously considering the introduction at our next session of the legislature of specific recommendations that will require industries to report to us in more detail what is going into their product and what is the complete makeup of the wastes that are being discharged directly or indirectly to the water environment. This, of course, has come out of our recent experience with mercury and some of the other heavy metals.

I would advise you that on Tuesday of this week our special interim legislative committee did in fact respond to a request of the Wisconsin Department of Natural Resources and authorized the expenditure of $96,000 to increase our surveillance capability in the State of Wisconsin.

This report describes activities of the Department of Natural Resources directed at implementing pollution abatement in the Wisconsin section of the Lake Superior drainage basin since the April 29-30, 1970, Lake Superior Enforcement Conference.

Original orders issued to Wisconsin sources of pollution in the Lake Superior basin generally required the provision of adequate treatment facilities in keeping with the interstate water quality standards. Since these orders were issued prior to the convening of the Lake Superior Conference, they did not anticipate such important conference recommendations as phosphorus removal. Further, investigations this spring disclosed additional pollutional sources in the Superior area that were not covered by existing orders.

On May 1, 1970, the Department held meetings with municipalities and industries to review status of compliance. These meetings, held in Ashland, were pre-enforcement conferences conducted jointly with the State Attorney General to evaluate progress under existing orders.

A public hearing was held on May 25, 1970, at Superior to formally present the recommendations of the pre-enforcement conferences and cite additional pollution sources. I might add that we invited a representative from the Federal Water Quality Administration to participate in these hearings and we were gratified that a representative of your agency did attend and make a contribution to the record of that hearing.

As a result of the hearing orders were issued on July 31, 1970. The Cities of Superior, Ashland and Hurley, the major Wisconsin municipalities in the basin, are being required to provide phosphorus treatment removal facilities to achieve not less than 85 percent removal of total phosphorus. Additionally, 16 orders were issued to pollution sources in the Superior area. The latter orders require connection to the municipal sewerage facilities within time limits of between two to fourteen months, depending on the individual situation. The attached tabulation of wastewater sources affecting Lake Superior reflects and includes the recent connection orders.

Since the last meeting of the conference, the Cities of Superior and Ashland have taken official actions on phosphorus removal by authorizing their engineers to proceed with plans for such facilities. Further evaluation of treatment effectiveness is needed at American Can Company, Ashland, to determine if precipitation-sedimentation facilities are achieving an adequate BOD as well as suspended solids reduction. Although present operations and method of waste disposal at the Pure Air Sanitorium provide protection to the water quality of Lake Superior, the treatment system is borderline in suitably disposing of the effluent. Consideration is being given to changing the institution to a home for the aged. The Department has encouraged joint treatment facilities with a nearby marina.

From the recent hearing and meetings held with communities and industries, it is apparent that the October 1, 1970, deadline will not be met in all instances. The Department's Bureau of Legal Services has these cases where delinquency is anticipated under advisement, and will determine enforcement action that will be taken. Whatever the legal action, it appears that the earliest date for completion of construction would be December 1971.

On August 5, 1970, we were notified by the duPont company that TNT production at Barksdale was being discontinued and operations would cease by March 31, 1970 (sic). The Department intends to permit the present method of disposal to continue during this phasing-out period.

I would like at this time to read for the record a communication that was addressed to the department by the E. I. duPont de Nemours Company. This letter is addressed to Mr. Thomas G. Frangos, Administrator, Division of Environmental Protection, Department of Natural Resources, Madison, Wisconsin.

(The letter was read in its entirety by Mr. Frangos.)

MR. FRANGOS: I have attached the release that the company provided, but I will not read it at this time.

MR. STEIN: Do you want the release in the record too?

MR. FRANGOS: Yes.

MR. STEIN: All right, without objection we will do it.

(Which letter, and the release referred to, follow:)

EX-1202 REV. 5-69

DU PONT
REG. U.S. PAT. OFF.
ESTABLISHED 1802
E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
BARKSDALE WORKS
P.O. ADDRESS: ROUTE #3—BOX 500
ASHLAND, WISCONSIN 54806

FREIGHT ADDRESS
BARKSDALE, WISCONSIN

EXPRESS ADDRESS
ASHLAND, WISCONSIN

TELEGRAPHIC ADDRESS
BARKSDALE, WISCONSIN

TELETYPE NUMBER
715-231-0800

EXPLOSIVES DEPARTMENT

August 5, 1970

Mr. Thomas G. Frangos, Administrator
Division of Environmental Protection
Department of Natural Resources
State of Wisconsin
Box 450
Madison, Wisconsin 53701

Dear Mr. Frangos:

The Wisconsin plan for implementation of Interstate Water Quality Standards calls for adequate treatment or disposal of waste associated with TNT manufacture at Barksdale. In June, 1969, we submitted an engineering report and final plans for an underwater dispersion line for disposal of red water.

In January, 1970, we discussed with you an alternate disposal method. That method would have consisted of evaporation and incineration to reduce the waste to a colorless ash. Engineering plans on this are well advanced.

A tentative timetable for the installation, as given in your letter to Mr. Murray Stein, Chairman of the Lake Superior Enforcement Conference, was completion of the project by May 1, 1972. Interim dates of August 1, 1970, for submission of plans and December 1, 1970, for start of construction were specified.

Three months have elapsed and FWQA has not yet responded to your letter. If I assume that three months should be added to the tentative schedule then new interim dates could be established. These dates might be November 1, 1970, for submission of plans and March 1, 1971, for start of construction.

We have determined after an intensive, long-range study of the market for TNT that there is no future in this market for us. We are telling our employees today that the Company is closing down its TNT and acid operations because of changing conditions and competition from other types of lower cost explosives. Details of the close-down are contained in the attached copy of the news release issued today.

Although the November 1, 1970, date for submission of plans on pollution abatement could be met, I request that a new schedule be established showing the cessation of operation as of March 31, 1971. You will note in the release that although current and planned expenditures in pollution control were a factor in the total economics, they were not significant in the final decision to close down the TNT and acid operations.

The period of August 1970, through March 1971, will be used to provide for an orderly shutdown of the facilities and will enable us to help our employees seek other employment.

Sincerely,

TE Rafferty

T. E. Rafferty, Manager

TER:djl

E. I. DU PONT DE NEMOURS AND COMPANY (INC.)
PUBLIC RELATIONS DEPARTMENT
WILMINGTON, DELAWARE 19898

BARKSDALE, Wis., Aug. 5 -- The Du Pont Company plans to discontinue operation of the TNT plant and all acid facilities at its Barksdale (Wis.) Works at the end of March, 1971.

Plant Manager Thomas E. Rafferty told employees today that the company is withdrawing from the TNT market because of decreasing customer demands and constantly increasing competition from other types of lower cost explosives. The plant is the only one in the United States that manufactures TNT for commercial sale, all the others being Government owned.

Present plans are to retain about 10 per cent of the current work force of 215 at the site to continue the manufacture of industrial grade synthetic diamonds, the preparation of explosives used in making the diamonds and for explosion bonding of metals, and the manufacture of "Nitramon" S primers. Efforts will be made to secure other employment for those not eligible for full pension. Included among the employees are 13 eligible for full pension, 83 for reduced pensions, and 28 for deferred pensions. All regular employees not pensioned will receive severance pay and other benefits.

The decision to discontinue TNT and acid operations was reached, Mr. Rafferty said, only after an intensive long-range study of future markets. The study confirmed a continuing decline in commercial application of TNT.

Mr. Rafferty said the disappearing commercial market for TNT was brought about by the increased use of prilled ammonium nitrate, water gels and other lower cost explosives which are not practical to make at Barksdale. This, he said, makes it uneconomical to continue the operations at the plant.

Mr. Rafferty said that although current and planned expenditures for pollution control were a factor in the total economics, they were not significant in the final decision to close out the TNT and acid operations.

"The decision to terminate TNT and acid operations at Barksdale Works was reached after exhaustive and careful consideration of all engineering, research, and economic factors by local and company management," Mr. Rafferty said. "It is a difficult decision, and we regret that we are forced to curtail operations at our Barksdale Works and end our fine association with many loyal and able employees."

Du Pont has operated Barksdale Works since 1904 and the TNT operation intermittently since 1912. The plant was built originally as a dynamite plant to supply the iron ore mines in Michigan, Wisconsin and Minnesota. As the underground mines closed down, manufacture of explosives at the plant changed from nitroglycerin-based products (dynamite) to TNT-based products. The dynamite operation was shut down in 1961.

# # # # # #

8/5/70

MR. FRANGOS: The purpose for my taking time to read this was to explain to the conferees, because of the previous interest in this matter, precisely what the situation is.

MR. STEIN: I understand the situation.

While we are on this, we have had experience with Federal installations closing out where they don't--say they are not going to put in a facility because they are closing out, and we have these dates, and I guess as you well know, Tom, these dates have a way of stretching on and on and on.

MR. FRANGOS: Yes.

MR. STEIN: Now, the notion is, do you consider this a pretty firm commitment that du Pont is going to shut its plant?

MR. FRANGOS: Well, I think we have to take, of course, the statement of the company at face value. If this is any measurement of their intention, their pollution man from Wilmington flew to Madison and at the same date that they were announcing the date to their employees they were also advising us of what they were doing, so I believe that they have considered this and they mean it.

The Department of Natural Resources is cognizant of the problem associated with providing adequate water treatment in this area, both economic and technical. New Federal and State funding programs, together with increased enforcement efforts, should permit Wisconsin to meet the conference abatement schedules.

(Which statement and attachments follow:)

Department of Natural Resources
Madison, Wisconsin 53701

REPORT TO THE LAKE SUPERIOR ENFORCEMENT CONFERENCE
Duluth, Minnesota - August 12-13, 1970

This report describes activities of the Department of Natural Resources directed at implementing pollution abatement in the Wisconsin section of the Lake Superior drainage basin since the April 29-30, 1970, Lake Superior Enforcement Conference.

Original orders issued to Wisconsin sources of pollution in the Lake Superior basin generally required the provision of adequate treatment facilities in keeping with the interstate water quality standards. Since these orders were issued prior to the convening of the Lake Superior Conference, they did not anticipate such important conference recommendations as phosphorus removal. Further, investigations this spring disclosed additional pollutional sources in the Superior area that were not covered by existing orders.

On May 1, 1970, the Department held meetings with municipalities and industries to review status of compliance. These meetings, held in Ashland, were pre-enforcement conferences conducted jointly with the State Attorney General to evaluate progress under existing orders.

A public hearing was held on May 25, 1970, at Superior, to formally present the recommendations of the pre-enforcement conferences and cite additional pollution sources. As a result of the hearing, orders were issued on July 31, 1970. The Cities of Superior, Ashland and Hurley, the major Wisconsin municipalities in the basin, are being required to provide phosphorus treatment removal facilities to achieve not less than 85 percent removal of total phosphorus. Sixteen orders were issued to pollution sources in the Superior area. The latter orders require connection to the municipal sewerage facilities within time limits of two to fourteen months, depending on the individual situation. The attached tabulation of waste water sources affecting Lake Superior includes the recent connection orders.

Since the last meeting of the conference, the Cities of Superior and Ashland have taken official actions on phosphorus removal by authorizing their engineers to proceed with plans for such facilities. Further evaluation of treatment effectiveness is needed at American Can Company, Ashland, to determine if precipitation-sedimentation facilities are achieving an adequate BOD as well as suspended solids reduction. Although present operations and method of waste disposal at the Pure Air Sanitorium provide protection to the water quality of Lake Superior, the treatment system is "borderline" in suitably disposing of the effluent. Consideration is being given to changing the institution to a home for the aged. The Department has encouraged joint treatment facilities with a nearby marina.

From the recent hearing and meetings held with communities and industries, it is apparent that the October 1, 1970 deadline will not be met in all instances. The Department's Bureau of Legal Services has these cases where delinquency is anticipated under advisement, and will determine enforcement action that will be taken. Whatever the legal action, it appears that the earliest date for completion of construction would be December 1971.

On August 5, 1970, we were notified by Du Pont that TNT production at Barksdale was being discontinued and operations would cease by March 31, 1971. The Department intends to permit the present method of disposal to continue during the phasing-out period.

The Department of Natural Resources is cognizant of the problem associated with providing adequate water treatment in this area--both economic and technical. New Federal and State funding programs, together with increased enforcement efforts, should permit Wisconsin to meet the conference abatement schedules.

Attach.

WISCONSIN WASTEWATER SOURCES AFFECTING LAKE SUPERIOR

Page 1
Municipalities
August 12, 1970

Source (Order No.)	Receiving Waters	Existing Treatment	Remedial Needs	Intrastate Water Quality Impl. Date	Status	Comments
Ashland (1-68-2) (4B-70-28-18)	Lake Superior	Primary Disinfection	Secondary Clear Water Phosphorus	10/1/70 10/1/77 None	Preliminary plans prepared. Rehearing held. Legal action pending.	State order requiring 85% phosphorus removal by 12/74.
Bayfield (1-68-4)	Lake Superior	Primary Disinfection	Secondary Clear Water	10/1/70 10/1/77	Preliminary report prepared. Rehearing held. Legal action pending.	
Hurley (1-68-11) (4B-70-28-19)	Montreal River	Primary Disinfection	Secondary Clear Water Phosphorus	10/1/70 10/1/77 None	City failed to comply with State Legal Staff agreement. Legal action pending.	State order requiring 85% phosphorus removal by 12/74.
Superior (1-68-26) (4B-70-28-17)	Lake Superior	Primary Disinfection	Secondary Clear Water Phosphorus	10/1/70 10/1/77 None	Preliminary engineering report prepared. Legal action pending.	State order requiring 85% phosphorus removal by 12/74.
Washburn (1-68-30)	Lake Superior	Primary Disinfection	Secondary Clear Water	10/1/70 10/1/77	Preliminary engineering plans prepared. Legal action pending.	

WISCONSIN WASTEWATER SOURCES AFFECTING LAKE SUPERIOR

Page 1
Industries
August 12, 1970

Source (Order No.)	Receiving Waters	Existing Treatment	Remedial Needs	Intrastate Water Quality Impl. Date	Status	Comments
Superior Fiber Prod. Co., Superior (1-68-26)	Lake Superior	Chemical and Screening	San. Sew. Trt. Ind. Waste Trt.	- 10/1/70	Delinquent on State order for san. sew. treatment. Rehearing held.	Attempting to "close" water cycle for ind. waste treatment.
American Can Co., Ashland (1-68-3)	Lake Superior	Mechanical Centrifuge Clarifier	None	None	Satisfied State order. Additional treatment needs being evaluated.	Investigating sludge incineration.
E. I. Du Pont de Nemours, Barksdale (1-68-7)	Boyds Creek	Neutralization Flow Equalization	Adeq. Ind. Waste Treatment	10/1/70	Plant to be closed.	Status quo until 3/31/71.
ADM Grain Co., Superior (4B-70-28-1)	St. Louis Bay	None	San. Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Burlington & Northern R.R., Superior (4B-70-28-2)	Superior Bay	None	San. Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	

WISCONSIN WASTEWATER SOURCES AFFECTING LAKE SUPERIOR

Source (Order No.)	Receiving Waters	Existing Treatment	Remedial Needs	Intrastate Water Quality Impl. Date	Status	Comments
Cutler-LaLiberte, Superior (4B-70-28-3)	Superior Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Douglas County Fairgrounds, Superior (4B-70-28-4)	Surface Drainage	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 12/1/70.	
Exports, Inc. Superior (4B-70-28-5)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 12/1/70.	
Farmers Union GTA, Superior (4B-70-28-6)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Frazer Shipyards, Superior (4B-70-28-7)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Dr. Garvey Animal Hosp., Superior (4B-70-28-8)	Nemadji River	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	

WISCONSIN WASTEWATER SOURCES AFFECTING LAKE SUPERIOR

Source (Order No.)	Receiving Waters	Existing Treatment	Remedial Needs	Intrastate Water Quality Impl. Date	Status	Comments
Globe Elevator, Superior (4B-70-28-9)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Great Lakes Coal & Dock Company, Superior (4B-70-28-10)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Huron Portland Cement Company, Superior (4B-70-28-11)	Superior Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
M & O Elevators, Inc., Superior (4B-70-28-12)	Superior Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Northern Engrg. Co., Superior (4B-70-28-13)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/70.	

WISCONSIN WASTEWATER SOURCES AFFECTING LAKE SUPERIOR

Industries
August 12, 1970

Source (Order No.)	Receiving Waters	Existing Treatment	Remedial Needs	Intrastate Water Quality Impl. Date	Status	Comments
Cutler-LaLiberte, Superior (4B-70-28-3)	Superior Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Douglas County Fairgrounds, Superior (4B-70-28-4)	Surface Drainage	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 12/1/70.	
Exports, Inc. Superior (4B-70-28-5)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 12/1/70.	
Farmers Union GTA, Superior (4B-70-28-6)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Frazer Shipyards, Superior (4B-70-28-7)	St. Louis Bay	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	
Dr. Garvey Animal Hosp., Superior (4B-70-28-8)	Nemadji River	None	Sanitary Sewage Treatment	None	State order requiring adequate treatment by 10/1/71.	

WISCONSIN WASTEWATER SOURCES AFFECTING LAKE SUPERIOR

Page 4
Industries
August 12, 1970

Source (Order No.)	Receiving Waters	Existing Treatment	Remedial Needs	Intrastate Water Quality Impl. Date	Status	Comments
Peavy Flour Mills, Superior (4B-70-28-14)	Superior Bay	None	San. Sew. Trt. Ind. Waste Trt.	None	State order requiring adequate treatment by 10/1/71.	
C. Reiss Coal Co., Superior (4B-70-28-15)	Superior Bay	None	San. Sew. Trt.	None	State order requiring adequate treatment by 10/1/71.	
Soo Line R.R., Superior (4B-70-28-16)	St. Louis Bay	None	San. Sew. Trt.	None	State order requiring adequate treatment by 10/1/71.	

8-11-70
JM

MR. STEIN: Thank you, Mr. Frangos.

Are there any comments or questions?

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes, Mr. Badalich.

MR. BADALICH: Mr. Frangos, for a matter of clarification of your attached listing, on page number 1 you list Ashland, Bayfield, Hurley, Superior and Washburn as legal action pending. Does this mean that they failed to heed the department's orders and in turn you are going to take legal action against these municipalities?

MR. FRANGOS: Well, what we are saying in this table is that the deadline for completion of construction is October of this year and there is no way that they are going to build a treatment plant between today and the first of October.

Now, a problem that we have is a question under State law whether we can proceed on an anticipatory assessment of this deadline date. So this again is under advisement between ourselves and the Attorney General.

MR. STEIN: Mr. Frangos and Mr. Badalich, I am glad you brought this question up, because this is precisely the problem that we are faced with, and I think this is one of the most delicate areas of Federal-State relations.

When you get a situation like that, and we are having a lot of cases coming up on the standard-setting operation where it is obvious to even the most casual observer that the date is not going to be met, without these interim dates and an indication of what the State is doing and what they have done to meet that, the question comes up as to whether, since this might be a violation of the Federal standards, we should institute the action on the Federal level. I think it behooves us all to get full exchange of information before that decision can be made.

And I say this because these are the questions that are asked of me. As you people know, and maybe we are a little bigger now, before I would take any action I would call you personally. I think there are so many where the people who I report to look at the reports and make a determination, and I think we should look at this and recognize that times have changed and we have to accommodate ourselves to the new situation.

MR. BADALICH: Well, Mr. Chairman, I am wondering if maybe you should ask Mr. Frangos whether he needs Federal help.

MR. STEIN: Well, generally speaking--

MR. FRANGOS: We take the Federal help any place we can find it. The last thing in the world I am going to do here at this conference, and certainly with you, Murray, is to beat the dead horse of States rights.

(Laughter.)

MR. STEIN: I don't know whether it needs Federal help or not, but like Minnesota I never saw Wisconsin turn down any of our money.

(Laughter.)

MR. FRANGOS: We do have a request in, by the way. (Laughter.)

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes.

MR. FRANGOS: For money. (Laughter.)

MR. STEIN: When I say "our money," that is advisable, you know, in the sense it comes from Federal sources. It is certainly yours as well.

MR. BADALICH: Mr. Frangos, if I understand you correctly, then, this "legal action pending," that means that these particular municipalities will meet the compliance deadline of the conference?

MR. FRANGOS: Yes, I don't see any problem with that. I think that the trouble is that we have got imposed deadlines that are earlier in this conference.

MR. BADALICH: Yes, we have.

MR. FRANGOS: And the thing that we, I think, all want to avoid is to have the conference serve as a vehicle to extend any dates. Now, we have not been doing this, nor do we look at the conference as this kind of an operation.

I think we have got two ways to go and it depends on these individual communities. One, we either ask our Attorney General to take legal action or we as an administrative agency extend the deadline through our own powers that we possess. But we have been in fact meeting with these communities to push them to get the kind of timetables that we can get some kind of assurances that we are going to reasonably get compliance.

MR. STEIN: Are there any other questions?

You had one.

MR. MAYO: No; you answered it.

MR. STEIN: All right.

Thank you very much, Mr. Frangos.

MR. FRANGOS: I just want to ask, are there any Wisconsin people here that wish to make a statement?

Then that, I think, completes our presentation.

MR. STEIN: I know time is running short, but just let me raise one point. And if you want to, Mr. Frangos, we can put this off the record.

But they had a mercury problem of finding mercury in fish in Wisconsin recently, which was well publicized by the Department of Natural Resources. We sent Mr. Bryson up with an offer of Federal assistance. The State indicated it could handle the program itself and we went home and went to other places. And so we regard the States' requests very fine.

I do say, I think that the Federal-State relations we have, certainly with these States, are very good. And again I will say in Federal-States relations, if there isn't a certain amount of tension,you know something is wrong, so this is healthy.

MR. FRANGOS: We would concur. And I think an observation on your comment is that there is enough work for all of us these days, and I think we need to communicate, coordinate and develop information data and move forward jointly.

MR. STEIN: Right. Thank you very much.

MR. GRANT MERRITT: Mr. Stein, in answer to Mr. Frangos's question--

MR. STEIN: I thought you knew the rules here. We are not taking comments from the floor.

MR. MERRITT: Mr. Frangos asked if there were any Wisconsin residents here--

MR. STEIN: I ask you to sit down. You are just abusing this and you are the only one in this outfit that does it. Now, why do you persist in this?

MR. MERRITT: Mr. Frangos asked if there were any Wisconsin residents here.

MR. STEIN: Mr. Merritt, I told you there are no comments from the floor.

MR. MERRITT: Mr. Stein, we have a Wisconsin resident here who would like to respond to Mr. Frangos's question.

MR. STEIN: We do not take that material in the record.

Thank you, Mr. Frangos.

Are there any other comments or questions?

If not, we have some Federal representatives. Mr. Mayo.

MR. MAYO: Mr. Chairman, we will have a brief report on waste discharges from Federal activities in the Lake Superior Basin from Mr. Merrill Gamet, of the regional office in Chicago.

MERRILL GAMET, CHIEF
FEDERAL ACTIVITIES COORDINATION BRANCH
GREAT LAKES REGION, FEDERAL WATER QUALITY
ADMINISTRATION, U. S. DEPARTMENT OF THE INTERIOR
CHICAGO, ILLINOIS

MR. GAMET: Mr. Chairman, conferees.

I wish to present a summary of waste treatment and disposal at Federal installations with surface water discharges in the Lake Superior Basin. More detailed information regarding these installations is contained in the status report which is now being distributed to the conferees.

We are pleased to report on the accomplishments that have been made toward abatement of pollution at Federal installations in the Lake Superior Basin. I might say that we are glad also that the list that we feel obliged to report on is getting shorter and shorter. Hopefully we will see the day when we can say they are all in compliance.

Federal installations that have adequate treatment and are considered to be in compliance with Conference Recommendations are discussed in the status report, and are therefore omitted from this presentation. A tabular summary of compliance of all installations is appended.

U. S. AIR FORCE:

1. K. I. Sawyer Air Force Base - The USAF Regional Environmental Health Laboratory is currently conducting a study to determine design criteria for all requirements to comply with State and Enforcement Conference Recommendations. Funds have been requested to connect the industrial waste discharge to the Base sanitary sewer system. All necessary additional facilities will be completed or under construction by December 31, 1972.
2. Duluth Air Force Missile Site - Temporary chlorination equipment will be installed by October 1970. Fiscal year 1971 funds have been requested for installation of permanent chlorination facilities.

U. S. COAST GUARD:

1. Passage Island Light Station - Interim plans have been made to install a tile drain field in the summer of 1971 for use until such time as the installation is unmanned and automated.
2. Rock of Ages Light Station - Interim plans have been made to install a holding tank in the summer of 1971 for use until such time as the installation is unmanned and automated. Wastes will be evacuated and transported to the City of Hancock municipal system.
3. Duluth Entrance Harbor Light Station - This station is expected to be unmanned and automated by December 1970.

U. S. FOREST SERVICE:

1. Clark-Helen Day Use Area, Sylvania Campground - Construction of sewer system, aerated lagoon, spray irrigation and chlorination is 75 percent complete. Final completion is expected by October 1970.
2. Kenton Dwellings 1, 2 and 3 - Connection to the Kenton Ranger Station secondary sewage treatment plant is 40 percent complete.

Final completion is expected by October 1970.

3. Black River Campground - Design for replacement of septic tank with aerated lagoon and irrigation system is 20 percent complete. Construction funds are being requested for FY 72 with project completion by December 31, 1972.

VESSELS:

U. S. COAST GUARD:

1. The cutter "WOODRUSH" - Development and evaluation of a shipboard package secondary treatment plant has been in progress. Present indications are that such a unit will affect the seaworthiness of the vessel, because of ballast conditions. Attention is now being directed to the installation of holding tanks with dockside evacuation and connection to the municipal sewer system at Duluth.

U. S. CORPS OF ENGINEERS:

Two derrick boats, one dredge and three tow boats are presently equipped with macerator/chlorinators and a detention tank for chlorine contact. At this time a GATX recirculating-evaporating type of waste treatment unit is undergoing tests and evaluation on the Office Barge 761 in the Mississippi River. It is recommended that this type of device, or a similar type, be installed on the above-mentioned vessels as soon as possible.

This completes the statement about the individual installations. I would like to call attention to the tabular report which is appended here and which I would like to summarize.

Regarding shore installations, we have a total of 26 which are located in the Basin. Of this 26 there are 16 which are considered to have adequate facilities. Four installations are scheduled for compliance in 1970, two in 1971, four in 1972.

In regard to vessels, the Coast Guard--I should say there are a total of 13 vessels, 6 of which are considered to have adequate facilities and 7 have no established time schedule.

This completes the presentation of these installations.

(Which summary follows:)

SUMMARY OF WASTE TREATMENT AND DISPOSAL AT FEDERAL INSTALLATIONS WITH SURFACE WATER DISCHARGES IN THE LAKE SUPERIOR BASIN

(More detailed information is presented in the status report that has been distributed to the Conferees.)

This report has been prepared for presentation at the reconvened session of the Lake Superior Enforcement Conference, Duluth, Minnesota, August 12, 13, 1970. We are pleased to report on the accomplishments that have been made toward abatement of pollution at Federal installations in the Lake Superior Basin.

Federal installations that have adequate treatment and are considered to be in compliance with Conference Recommendations are discussed in the status report, and are therefore omitted from this presentation. A tabular summary of compliance of all installations is appended.

U.S. AIR FORCE:

1. K.I. Sawyer Air Force Base - The USAF Regional Environmental Health Laboratory is currently conducting a study to determine design criteria for all requirements to comply with State and Enforcement Conference Recommendations. Funds have been requested to connect the industrial waste discharge to the Base sanitary sewer system. All necessary additional facilities will be completed or under construction by December 31, 1972.
2. Duluth Air Force Missile Site - Temporary chlorination equipment will be installed by October 1970. FY 71 funds have been requested for installation of permanent chlorination facilities.

U.S. COAST GUARD:

1. Passage Island Light Station - Interim plans have been made to install a tile drain field in the summer of 1971 for use until such time as the installation is unmanned and automated.
2. Rock of Ages Light Station - Interim plans have been made to install a holding tank in the summer of 1971 for use until such time as the installation is unmanned and automated. Wastes will be evacuated and transported to the City of Hancock municipal system.
3. Duluth Entrance Harbor Light Station - This station is expected to be unmanned and automated by December 1970.

U.S. FOREST SERVICE:

1. Clark-Helen Day Use Area, Sylvania Campground - Construction of sewer system, aerated lagoon, spray irrigation and chlorination is 75% complete. Final completion is expected by October 1970.
2. Kenton Dwellings 1, 2 and 3 - Connection to the Kenton Ranger Station secondary sewage treatment plant is 40% complete. Final completion is expected by October 1970.
3. Black River Campground - Design for replacement of septic tank with aerated lagoon and irrigation system is 20% complete. Construction funds are being requested for FY 72 with project completion by December 31, 1972.

VESSELS:

U.S. COAST GUARD:

1. Cutter "WOODRUSH" - Development and evaluation of a shipboard package secondary treatment plant has been in progress. Present indications are that such a unit will affect the seaworthiness of the vessel, because of ballast conditions. Attention is now being directed to the installation of holding tanks with dockside evacuation and connection to the municipal sewer system at Duluth.

U.S. CORPS OF ENGINEERS:

Two derrick boats, one dredge and three tow boats are presently equipped with macerator/chlorinators and a detention tank for chlorine contact. At this time a GATX recirculating-evaporating type of waste treatment unit is undergoing tests and evaluation on the Office Barge 761 in the Mississippi River. It is recommended that this type of device, or a similar type, be installed on the above mentioned vessels as soon as possible.

I would like at this time to present a tabular summary of the status of all reported Federal installations, as follows: (Refer to the attached appendix)

August 1970

STATUS OF COMPLIANCE OF FEDERAL INSTALLATIONS HAVING SURFACE WATER DISCHARGES IN THE LAKE SUPERIOR ENFORCEMENT CONFERENCE AREA

Name of Agency	Total Installations	Adequate Facilities	Deadline for Compliance		No Est. Sched.	Date Scheduled for Compliance		
			Enf. Conf.	E.O. 11507		1970	1971	1972
Shore Installations								
U.S. Coast Guard	8	5		12/31/72		1	2	
U.S. Forest Service	9	4		"		2		3
U.S. Air Force	4	3		"				1
	1		5/70			1		
Bur. of Sports Fisheries & Wildlife	2	2						
U.S. Dept. of Justice, Imm. & Nat.Service	1	1						
U.S. Corps of Engineers	1	1						
TOTAL	26	16				4	2	4
Vessels								
U.S. Coast Guard	1				1			
Corps of Engineers	6				6			
National Park Service	6	6						
TOTAL	13	6			7			

SURFACE WATER DISCHARGES
from
FEDERAL INSTALLATIONS
in the LAKE SUPERIOR BASIN

AUGUST 1970

GREAT LAKES REGION

STATUS OF COMPLIANCE WITH ENFORCEMENT CONFERENCE REQUIREMENTS

LAKE SUPERIOR BASIN

DATE OF INFORMATION Aug. 1970
PREPARED BY

DESIGNATED SOURCE & LOCATION	RECEIVING WATERS	REMEDIAL NEEDS	Present Treatment	REQUIRED CONSTRUCTION SCHEDULE	STATUS OF COMPLIANCE CONSTRUCTION	Pop. and/or 1,000 GPD	COMMENTS AND/OR REASON FOR DELAY
MICHIGAN							
U.S. Coast Guard							
Keweenaw Lower Entrance Light Station (Houghton Co.)	Lk.Superior	None	Sec. Cl_2	Compl.		11 P	In compliance with Recommendation No. 20 of the Enforcement Conference.
Eagle Harbor Light Sta. Eagle Harbor (Keweenaw Co.)	Lk.Superior	None	Sec. Cl_2	Compl.		7 P	In compliance with Recommendation No. 20 of the Enforcement Conference.
Passage Island Light Sta. (Keweenaw Co.)	Lk.Superior	3, 2	ST	FI	00	5 P (0.12)	Existing facilities consist of a 900-gallon septic tank with discharge to Lake Superior. Proposed unmanning, 1974-76. The USCG has been advised of the Dec. 1972 deadline. Interim plans have been made to comply with conference recommendations. Installation of a tile drainfield is scheduled for Summer 1971.
Rock of Ages Light Sta. (Keweenaw Co.)	Lk.Superior	3, 2	None	FI	00	5 P	Station has no treatment. All wastes discharged to Lake Superior. Proposed unmanning 1974-76. The USCG has been advised of the Dec. 1972 deadline. Interim plans have been made to comply with Conference Recommendations. Installation of a sewage holding tank is scheduled for summer 1971. Wastes will be treated by the City of Hancock municipal sewage facilities.
Huron Island Light Sta. West Huron Island (Marquette Co.)	Lk.Superior	None	Sec. Cl_2	Compl.		5 P	In compliance with Recommendation No. 20 of the Enforcement Conference.

KEY: CONSTRUCTION PHASE
(PP) Preliminary Plans
(FP) Final Plans
(FI) Financing
(C) Construction

STATUS OF COMPLIANCE
(+) Ahead of Schedule
(=) On Schedule
(0) Behind Schedule (Less than 1 year)
(00) Behind Schedule (Over 1 year)
(*) Unilateral Extension Given by State

REMEDIAL NEEDS
(1) Sample &/or Report
(2) Disinfection
(3) Secondary Treatment or Equivalent
(4) Phosphorus or Nutrient Removal
(5) New or Improved Trt.
(6) Plant Expansion
(7) Reduction, Removal or Neutralization of: Acid, (Cl) Chloride, (Cu) Copper, (CN) Cyanide, (Fe) Iron, (M) Metals, (N) Nitrogen, Oil, (BOD) Oxygen Demand, (Pn) Phenol, (S) Solids, (TO) Threshold Odor,
(8) Connect to Municipal System
(9) Separation or Control of Combined Sewers
(10) Storm Sewer Treatment
(11) Exclude Clear Water
(12) Sewers
(13) Adequate Treatment
(14) Improve Operation
(15) Evaluate Present Facilities
(16) Reduction of All Critical Constituents
(17) Advanced Waste Treatment

(Compl.) Completed
(HT) Holding Tank
(ST) Septic Tank
(DF) Drain Field
(P) Persons

GREAT LAKES REGION

STATUS OF COMPLIANCE WITH ENFORCEMENT CONFERENCE REQUIREMENTS

LAKE SUPERIOR BASIN

DATE OF INFORMATION
Aug. 1970
PREPARED BY

DESIGNATED SOURCE & LOCATION	RECEIVING WATERS	REMEDIAL NEEDS	Present Treatment	REQUIRED CONSTRUCTION SCHEDULE	STATUS OF COMPLIANCE CONSTRUCTION	Pop. and/or 1,000 GPD	COMMENTS AND/OR REASON FOR DELAY
MICHIGAN, Cont'd.							
U.S. Dept. of Agriculture Forest Service Ottawa National Forest							
Clark-Helen Day Use Area, Sylvania Campground and Recreation Area (Gogebic Co.)	G	3, 2	None	CO	=	150 P	Construction of sewer system, aerated lagoon, spray irrigation facilities plus chlorination is 75% completed. Final completion is expected by October 1970.
Kenton Dwelling No. 1, 2 & 3 (Houghton Co.)	G	3, 2	None	CO	=	1.20	Construction work to connect the dwellings to the Kenton Ranger Station package sewage treatment plant is 40% complete. Final completion is expected by October 1970.
Kenton Ranger Station (Houghton Co.)	Ontonagon River Lk.Superior	None	Sec.,sand filter, Cl_2	Compl.		0.80	In compliance with Recommendation No. 20 of the Enforcement Conference.
Bergland Ranger Station Office, Bergland (Ontonagon Co.)	G	None	ST, DF	Compl.		0.20	In compliance with Recommendation No. 20 of the Enforcement Conference.
Black River Campground (Ontonagon Co.) (Boat docking facilities)	G	3, 2	ST	FP, CO	=	12.0	Design for replacing septic tank with aerated lagoon and irrigation system is 20% complete. Completion date expected by Spring 1971. Construction funds will be requested in FY 72. Construction completion date December 31, 1972.
U.S. Air Force							
Calumet Air Force Station Ahmeek (Keweenaw Co.)	Ditch to Creek to Lk.Superior	4	Sec.,Cl_2	Compl.	=	32.0	In compliance with Recommendation No. 20 of the Enforcement Conference.

KEY: CONSTRUCTION PHASE
Preliminary Plans
Final Plans
Financing
Construction

STATUS OF COMPLIANCE
(+) Ahead of Schedule
(=) On Schedule
(O) Behind Schedule (Less than 1 year)
(OO) Behind Schedule (Over 1 year)
(*) Unilateral Extension Given by State

REMEDIAL NEEDS
(1) Sample &/or Report
(2) Disinfection
(3) Secondary Treatment or Equivalent
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(16) Reduction of All Critical Constituents
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(Compl.) Completed
(HT) Holding Tank
(ST) Septic Tank
(DF) Drain Field
(P) Persons

GREAT LAKES REGION

STATUS OF COMPLIANCE WITH ENFORCEMENT CONFERENCE REQUIREMENTS

LAKE SUPERIOR BASIN

DATE OF INFORMATION
Aug. 1970
PREPARED BY

DESIGNATED SOURCE & LOCATION	RECEIVING WATERS	REMEDIAL NEEDS	Present Treatment	REQUIRED CONSTRUCTION SCHEDULE	STATUS OF COMPLIANCE CONSTRUCTION	Pop. and/or 1,000 GPD	COMMENTS AND/OR REASON FOR DELAY
MICHIGAN, Cont'd.							
U.S. Air Force, Cont'd.							
K.I.Sawyer Air Force Base Republic (Marquette Co.)							
Sanitary Wastes	**Silver Lead** Creek, tributary to Lk.Superior	4	Sec. Cl_2	PP	=	668.0	USAF Regional Environmental Health Laboratory is conducting an investigation. A pilot plant study is currently underway to obtain design criteria for facilities to comply with existing State Standards. Expected completion date for studies is January 1, 1971. Treatment facilities required for compliance with Executive Order 11507 and the Enforcement Conference recommendations will be completed or under construction by December 31, 1972.
Industrial Wastes			Holding & settling tanks with oil skimming devices & lagoon				The Air Force has requested funds for connecting the industrial waste discharge to the Base sanitary sewer system. This work cannot be accomplished, however, until the implementation of the above plans. Est. cost $59,000. This work will be completed or underway by Dec. 31, 1972.
U.S. Dept. of the Interior Bur. of Sport Fisheries & Wildlife							
Pendills Creek National Fish Hatchery, Brimley (Chippewa Co.)	Pendills Creek to Lk.Superior	None	None			5,750.0	In compliance with Recommendation No. 20 of the Enforcement Conference.
Hiawatha Forest Fish Hatchery, Raco (Chippewa Co.)	Sullivans Creek to Lk.Superior	None	None			4,220.0	In compliance with Recommendation No. 20 of the Enforcement Conference.

KEY: CONSTRUCTION PHASE
Preliminary Plans
Final Plans
Financing
Construction
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STATUS OF COMPLIANCE
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(=) On Schedule
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MINNESOTA							
U.S. Coast Guard							
Duluth Entrance Harbor Light Station Duluth (St.Louis Co.)	Lk.Superior	Sec. Cl_2	None	FI	=	4 P	Station is expected to be unmanned and automated by Dec. 1970.
U.S. Dept. of Agriculture Forest Service - Superior National Forest							
Tofte Administrative Site (Cook Co.)	G	None	Sec. Cl_2	Compl.		10 P (75 P in future)	In compliance with Recommendation No. 20 of the Enforcement Conference.
White Face Reservoir Camp Picnic Ground (St.Louis Co.)	G	3, 2	None	FI	=	445 P (10,000 GPD) (future)	FY 1971 funds have been approved for the construction of a sewer system, aerated lagoon, and spray irrigation system. Construction completion date summer 1972.
Eveleth Nursery Administration and Nursery Eveleth (St.Louis Co.)	G	None	Sec. Cl_2	Compl.		0.8	In compliance with Recommendation No. 20 of the Enforcement Conference.
U.S. Air Force							
Finland Air Force Station Finland (Lake Co.)	Surface drainage to tributary of Baptism River thence Lk.Superior	None	Sec. Cl_2	Compl.		35.0	In compliance with Recommendation No. 20 of the Enforcement Conference.

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MINNESOTA, Cont'd.							
U.S. Air Force, Cont'd.							
Duluth Air Force Missile Site, Duluth (St.Louis Co.)	Roadside Ditch	2	Sec.	FI	=	1.0	Sanitary wastes are treated in an extended aeration package treatment plant, the effluent from which is discharged without chlorination to a ditch that terminates two miles from the nearest body of water. Station has been informed of May 1970 deadline for providing chlorination. Temporary chlorination equipment will be installed by October 1970. FY 71 funds have been requested for permanent chlorination facilities.
Minnesota National Guard Duluth (St.Louis Co.)	Miller's Creek	None	None	Compl.		12.0	In compliance with Recommendation No. 20 of the Enforcement Conference.
U.S. Dept. of Justice Immigration and Naturalization Service							
Border Patrol Station Grand Marais (Cook Co.)	Ground and Pigeon River	None	Sec. Cl_2	Compl.		2.0	In compliance with Recommendation No. 20 of the Enforcement Conference.
U.S. Army (Corps of Engineers)							
U.S. Vessel Yard Duluth (St.Louis Co.)	G	None	None	Compl.		0.20	In compliance with Recommendation No. 20 of the Enforcement Conference.

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WISCONSIN							
U.S. Coast Guard							
Bayfield Station Bayfield (Bayfield Co.)	None	None	Incinerator type toilet	Compl.		1 P	In compliance with Recommendation No. 20 of the Enforcement Conference.
Superior Entry South Breakwater Light Station Superior (Douglas Co.)	Allouez Bay	None	ST, DF	Compl.		11 P	In compliance with Recommendation No. 20 of the Enforcement Conference.
U.S. Dept. of Agriculture Forest Service Chequamegon National Forest							
Two Lakes Campground (Bayfield Co.)	G	3, 2	None	PP	=	13.0	Preliminary plans for the construction of a waterborne system with aerated lagoon, irrigation and disinfection have been completed. FY 71 design funds have been requested for this project, and completion is expected by Dec. 1972.

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VESSELS							
MINNESOTA							
U.S. Coast Guard							
USCG WOODRUSH	Lk.Superior area of operation	3, 2	None	FI	=	47 P	Development work is in progress for a small package secondary sewage treatment plant plus chlorination that could be utilized on board. It appears that this effort will not be successful due to the inability to develop a compact unit which does not adversely affect the seaworthiness of the vessel. As a result, planning is now turning in the direction of a sewage holding tank. Shore waste unloading facilities will be provided at Duluth Harbor, with connection to the municipal sewer system.
U.S. Army (Corps of Engineers)							
Derrick Boat DK 20	Lk.Superior	3, 2	Macerator Chlorinator plus detention tank	-	=	5	Macerator/chlorinator and detention tank for chlorine contact installed; overboard discharge. A recirculating-evaporating-holding type of toilet is under test and evaluation on the Office Barge 761 in the Mississippi River. It is recommended that this, or a similar type of waste treatment unit be installed on all vessels as soon as possible.
Derrick Boat - COLEMAN	Lk.Superior	3, 2	"	-	=	11	" "
Dredge - GAILLARD	Lk.Superior	3, 2	"	-	=	27	" "
Tow Boat - MARQUETTE	Lk.Superior	3, 2	"	-	=	8	" "
Tow Boat - SUPERIOR	Lk.Superior	3, 2	"	-	=	9	" "
Tow Boat - DULUTH	Lk.Superior	3, 2	"	-	=	3	" "

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GREAT LAKES REGION

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LAKE SUPERIOR BASIN

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MICHIGAN							
VESSELS, Cont'd.							
National Park Service							
M.V. RANGER III (165')	Lk.Superior	None	HT	Compl.		138 P	In compliance with Recommendation No. 20 of the Enforcement Conference.
Tug J.E.COLOMBE (45')	Lk.Superior	None	HT	Compl.		2 P	In compliance with Recommendation No. 20 of the Enforcement Conference.
M.V. CONRAD L (26')	Lk.Superior	None	HT	Compl.		2 P	Portable holding tanks have been placed in service for emergency use.
M.V. DEMRAY (26')	Lk.Superior	None	HT	Compl.		2 P	" "
M.V. LOUIS J. (26')	Lk.Superior	None	HT	Compl.		2 P	" "
M.V.C.M. GOTHE (26')	Lk.Superior	None	HT	Compl.		2 P	" "

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MR. STEIN: Any comments or questions?

Thank you very much for your report, Mr. Gamet.

I think our weak point--Merrill, would you stay there--I think our weak point is those seven boats. Six of the boats belong to one portion of the government. Are we going to get any action?

MR. GAMET: They are the Corps of Engineers boats.

MR. STEIN: That is right. (Laughter.)

MR. GAMET: And there is a representative of the Corps of Engineers here today whom I think Mr. Mayo will call on to discuss this situation.

MR. STEIN: All right. Thank you.

MR. PURDY: May I ask a question?

MR. STEIN: Yes.

MR. PURDY: Mr. Gamet, with respect to the K. I. Sawyer Base, you say that it will be completed or under construction by December 31, 1972. This leaves me kind of grasping for just exactly what is going to take place.

MR. GAMET: Well, this is the language which is stated in Executive Order 11507. That is, nearly so. The Executive Order states, "be completed or under way."

We prefer to say, "or under construction," and we, believe me, are pushing as hard as we can to get them to step up their timetable so that they, if not completed, will be nearly completed by that time.

MR. PURDY: You mean, then, at the present time that the K. I. Sawyer Air Base has not established interim progress dates like have been established for other waste dischargers in the Basin?

MR. GAMET: No, they have not.

MR. STEIN: Have they given you any indication other than they generally are going to comply with the Executive Order as a basis for this report?

MR. GAMET: Well, about the only schedule that they have given us is the completion of the study which is under way at the present time, which they indicated would be probably about six months. Then as far as design of facilities and construction, we don't have any interim--any further interim time schedule, but we intend to get it.

MR. STEIN: I think we are going to have to pretty rapidly get interim time schedules from these Federal installations--

MR. GAMET: Right.

MR. STEIN: --if we are asking the States to provide those for cities and industries within their jurisdictions.

MR. GAMET: I agree. This will be done as soon as this study is completed.

MR. STEIN: Well, no, no, that is six months. I want a time schedule for them from all these installations where you don't have much within a month and I want to give it to the conferees.

MR. GAMET: All right, we will get it.

MR. STEIN: And if we don't have it we will just report it and I suspect it will do some good.

MR. GAMET: We will get the schedule.

MR. STEIN: The President has put out an Executive Order on this, and as far as I can determine he means to have action and they have provided the money.

MR. GAMET: Right.

MR. STEIN: And there is no excuse for not going ahead.

Thank you, Mr. Gamet.

MR. MAYO: The next statement, Mr. Chairman, will be given by Mr. Starkey Grove, Chief of the Maintenance Branch of the St. Paul District of the Corps of

Engineers.

STARKEY GROVE
CHIEF, MAINTENANCE BRANCH
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

MR. GROVE: Conferees, ladies and gentlemen.

This is more in the form of a progress statement than it is in the form of a hopeful end date. If you will just use the reference that has been made up to now to Office Barge 761 as being the unit on which this test is taking place, this is due to the fact that we are actually involved with a manufacturer in research and development of units that can be utilized on board our craft. Unfortunately, in all of the initial designs of our equipment, space limitations were minimized to a degree that did not allow for the large-type installations that would be required by present-day available hardware, so this prompted that we go to and involve ourselves with and we did take positive steps to go out to industry and work with them to accomplish this end.

To date this prompted one of the installations--many installations that the Corps has participated in, and we as one district of many were requested to deal with one of these manufacturers in the refinement of a given type of equipment. This corporation happened to be GATX, or General American Transportation Company, as spelled out prior to this time. This unit was a unit that was packaged around a similar unit that was used aboard aircraft. Actually it has a definite adaptation to our installations because of its compactness. This is the very thing that we are fighting.

We did install on April 21, 1970, a prototype of an adapted unit that came from the aircraft industry, only in a larger package form. We have had problems. I would have to say when you are involved in research and development of this sort you should expect it. I hasten to add that there is a great deal of hope that this unit will prove out to be the ultimate answer to our problems and we feel that it will, because none of the problems that we have had to date are of such a degree that we can see that they are insurmountable.

We just recently had a meeting, to which the FWQA was invited, to view and go over and question the manufacturers as to the progress of this unit to date. We feel that it has great promise. This is an evaporatorrecirculation type unit. Now, I should hasten to mention here that this type of unit would be used on our larger craft, preferably 11 or more people.

We also are in progress right now of negotiating with this company on a freshwater system that is a system that does not recircularize the water, but, rather, discharges it directly into the evaporator, and this is possible due to the lower utilization. You get into large crews such as we have aboard dredges, where we have anywhere from 35 to 65 people, this type of unit is entirely impractical because your water volume becomes too great. And we are in negotiations with them presently to take a new prototype, work with them in research and development of this unit on the tug SUPERIOR, which has approximately a complement of nine people.

To date this contract has not been consummated, but we hold a great deal of hope for the time when we can work with them on this.

The unit on the Mississippi River to date is showing great promise, as I stated before, and I feel will ultimately produce the answer we want.

Talking end dates, it is difficult to do this when you are in the area of basic research. There isn't any hardware available today that is applicable to our installations that we know of other than what we have here. In fact, it is narrowed down pretty much to this unit--

MR. STEIN: Would you repeat that?

MR. GROVE: The application that we have to make, based on the other tests that have been run, it has been made apparent to me that this is one of the few remaining that holds hope and a great deal rests on the development of this particular type of installation.

MR. STEIN: Are there any comments or questions?

MR. MAYO: Is there any question as to whether or not the successful operation in the Mississippi River instance will be applicable here on Lake Superior?

MR. GROVE: Definitely. We see this being applied, for instance, to the Dredge GAILLARD, which has approximately a complement of 36 men, also to the Derrick Boat COLEMAN, which has a similar large complement of people. We see our tugs having the other, the fresh-water application. But as yet this unit hasn't even been—a prototype hasn't been made so we can test it, because we are in the progress of negotiations with the manufacturer for contracts.

MR. STEIN: Any other questions or comments?

Mr. Grove, let me say something on this. You know, contrary to the general impression around, I didn't serve in the Spanish-American War, but I did in World War II. When I came back I went to the Public Health Service and I talked, among others, with someone a lot of people here may know, Frank Butrico, who was then in charge of vessel sanitation. That was in 1948, 1949, maybe.

The problem with getting sanitary facilities on vessels then was there wasn't enough room in design, over 20 years ago. The same answer.

The question that we have had here--I make no criticism of your statement, but the question, the kind of response we have gotten is that you are researching and you can't tell us when you are going to do it. I think the people who have been sitting at this table and dealing with shore installations have had that response from municipal and industrial sources for years, and at least for the last 10 years we haven't considered these actions.

I don't think we can proceed with this notion. We are talking about big companies like Reserve, U. S.

Steel, the City of Duluth doing something by a particular time date to get something out. If we don't work in an evenhanded manner and we can adopt the notion that you have got to research this on your ships, there isn't a discharger in the country or a person putting out pollutants that can't come up with that same answer. I think we are just going to have to come up with some special dates on this, particularly in view of the fact that we do have legislation now where we have to control these discharges from boats--Federal legislation, particularly where we have come up with an agreement of the States in Lake Michigan and Lake Erie that we are not going to permit any discharges from boats, and I don't know how we can ask the States at the behest of the Federal Government to do something that we are not doing ourselves.

MR. GROVE: I can't very well address myself to that.

MR. STEIN: I understand. Thank you very much.

I understand there are some other people who want to speak now.

Mr. Carson? Is there someone? Do we have any people in the audience who want to speak?

Mr. Merritt?

MR. MERRITT: Yes, we have Dr. Carson. Do you wish to go ahead now? He is available.

MR. STEIN: Yes.

MR. MERRITT: All right.

MR. STEIN: Are we ready? You know, it is getting late and some people here may be beyond their normal lunch hour. Let's try to be considerate.

By the way, who is going to make this statement? Are you? No? Where is the man?

MR. SHINER: I think he thought the statement wouldn't be made right now. Grant is looking for him now.

MR. STEIN: I don't think we can wait. I am sorry.

Go ahead.

I will be glad to put this in the record as if read. This will be done, without objection.

(Which statement follows:)

MECCA
(MINNESOTA ENVIRONMENTAL CONTROL CITIZEN'S ASSOCIATION)

Statement Before Federal-State Conference
On
Pollution Of Lake Superior August, 1970

The Case for On-Land Disposal of Taconite Tailings
From Reserve Mining Company
Now Polluting Lake Superior

Factual Summary of Current Status of the Case Against Reserve

Reserve Mining Company of Silver Bay, Minnesota, is jointly owned by Republic Steel and Armco Corporation, both based in Ohio. Since 1956 it has been dumping waste taconite tailings into Lake Superior until it reached 60,000 tons per day in recent years. Permits by both the state of Minnesota and the U. S. Army Corps of Engineers were granted Reserve for this purpose on the assumption that tailings were inert chemically and were carried into Superior's "deep trough" by a heavy density current.

Studies completed in December, 1968, by a U. S. Department of Interior study group * under the direction of Regional Coordinator, Charles H. Stoddard (Office of the Secretary) concluded that positive evidence of pollution existed as follows: (see page 2)

Since 1968, further evidence has been developed to show the following additional facts regarding the harmful effect of these tailings on the Lake. (see pages 4 & 5)

SUMMARY OF STUDY ON TACONITE WASTES DUMPED INTO LAKE SUPERIOR*

A Department of Interior Interagency Study Group has concluded, as a result of a 10-month study, that taconite wastes discharged by the Reserve Mining Company's ore processing plant at Silver Bay, Minnesota, are contaminating Lake Superior and should be disposed of elsewhere. The Department, in transmitting the report December 30, 1968, recommended to the U. S. Army Corps of Engineers that the permit it grants for disposal of the wastes be extended conditionally for three years to give the company time to construct on-land waste disposal facilities.

The study was undertaken under the authority of the Army-Interior Agreement of July 1967 at the request of the Corps of Engineers prior to its revalidation of a permit to allow Reserve Mining Company to continue discharging its wastes into Lake Superior. Under this agreement the Department of the Interior reviews the environmental effects of proposed dredging, filling, and excavation projects in navigable waters.

Five Department of Interior agencies took part in the study. Analyzing the effects of the tailings on aquatic life were the Federal Water Pollution Control Administration; the Bureau of Sport Fisheries and Wildlife; and the Bureau of Commercial Fisheries. The Geological Survey analyzed the man-made and natural siltation; the Bureau of Mines determined the chemical constituents of taconite and taconite wastes from the plant, and studied alternative disposal methods. The agencies received the full cooperation of Reserve Mining Company in preparing the report. The key regional officers of each agency participated in the preparation of the final report and concurred with its recommendations.

The investigators found that Federal-State water quality standards for iron, lead, and copper are being violated as a result of the discharge; that the tailings in laboratory tests encouraged the growth of undesirable algal blooms; that lake currents are strong enough to carry the suspended waste particles at least 18 miles; that turbidity caused by the discharge violates Minnesota State permit requirements; and that the suspended tailings, which cause the appearance of "green water", are dispersed on the lake bottom for 10 miles offshore and 18 miles southwest of the plant.

It also found that about half of the waste tailings are deposited on a delta above Lake Superior's deep trough. The remainder, very tiny particles which remain in suspension, are identifiable through the tracer chemical "cummingtonite" - not present in natural stream-borne silt. Scuba divers photographed clouds of fine tailings moving down the lakeshore with the waves and natural currents of the lake - in sharp contrast with adjacent clear water.

The task force found that the daily discharge of tailings to the lake is roughly equivalent to the nearly 60,000 tons of sediment that flows into the lake each year from its Minnesota tributaries.

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* U. S. Department of Interior - Office of the Secretary, December 1968

Besides "green water" discoloration, the increased turbidity caused by the taconite discharge creates other problems. The report notes that "light must penetrate great depths in Lake Superior in order to produce sufficient plankton (minute animal and plant life) to support the fish population that lives there. Whereas an increase in turbidity of a few parts per million in a very turbid lake would not be significant, in Lake Superior this increase in turbidity could greatly reduce the depth of the zone of water in which there is sufficient light to permit photosynthesis and, therefore, the growth of food.

The study added that the tailings are adversely affecting fish food production at least one mile into the lake, and that increased numbers of less desirable bottom life are evident in several places.

Noting the laboratory tests in which the sac fry of rainbow trout died after exposure to taconite wastes, the investigators said the results "suggest the important effect that..." tailings may have on such important species of fish as lake trout and lake herring. Both of these species deposit their eggs on the bottom and the eggs undergo a prolonged incubation period during which there is no parental care and they are subject to the hazards of the environment."

In other laboratory tests, the filtered taconite effluent stimulated the growth of Lake Superior algae "as compared to the growth potential of Lake Superior water alone." This does not imply that algal blooms will necessarily result, the task force report states, primarily because of the very cold temperature in the lake. But the tests do demonstrate that the taconite wastes are enriching and possibly accelerating the rate of aging of Lake Superior.

The report also says that the copper, zinc, chromium, and iron constituents found in Reserve Mining's waste discharge are a potential danger. These metals are highly toxic but presently biologically inactive. The study adds, however, that "the distinct possibility exists that these metals may gradually go into solution. Changing conditions may occur in the lake from the addition of other pollutants by municipalities, paper mills, or from materials carried into the lake by the tributary streams. Should conditions later change, it will then be too late to remove the pollutants from Lake Superior and a very serious problem could exist." The study group estimates that approximately two tons of copper per day is discharged to the lake in the taconite effluent.

The Bureau of Mines portion of the report suggests a possible alternative waste disposal site some five miles from the Reserve plant. Wastes could be pumped uphill in a pipeline to a diked impoundment where tailings would settle out, while waste water could be drawn off at another point for reuse as wash water. The added unit cost, the report estimates, would be 40 cents a ton, or three percent of the market value of taconite. The investment in disposal facilities of $7 million dollars is a tiny fraction of the $350 million dollar capital already in the plant and equipment owned by Republic Steel and Armco corporations.

EFFECTS OF TACONITE ON LAKE SUPERIOR

Federal Water Quality Administration - U. S. Department of Interior
Duluth, Minnesota - April 1970

Summary and Conclusions

I. Physical Characteristics of Green Water Along the North Shore of Lake Superior

Conclusions:

1. A major cause of "green water" along the north shore is tailings suspended in the water.
2. Not all green water masses occurring in Lake Superior are due to tailings.
3. Water clarity in green water, caused by tailings, is 4 to 10 times less than clarity in clear water.
4. The color is due to reflected light from suspended particles.

II. Distribution of Taconite Tailings in the Sediments of the Western Basin of Lake Superior

Conclusions:

1. Taconite tailings from the Reserve Mining Company at Silver Bay, Minnesota, are deposited discontinuously on the surface of the lake bottom over an area of at least 1,000 square miles in the western tip of Lake Superior.
2. The tailings are mixed in the top 5-10 cm of sediment.
3. The percentage of cummingtonite in tributary stream sediments accurately indicates the cummingtonite content found in the subsurface bottom sediments.
4. Tailings deposits are found in both Minnesota and Wisconsin waters. Although the sediments in Wisconsin waters contain very low percentages of taconite tailings, the tailings deposits are distinguishable quantitatively from stream sediments.

III. Effect of Taconite on Bacterial Growth

Conclusions:

1. Tailings are biologically active at concentrations of approximately 1 mg/l -- a concentration expected to occur over a significant area of the Lake.

2. The reduced die-away or enhanced growth is displayed by indicators of fecal contamination, as well as pathogenic bacteria.

IV. Taconite Bioassays

Conclusion:

Direct toxic effects of tailings on the lake organisms were found at concentrations that would be expected to occur only in local areas of the Lake.

V. Effect of Taconite Tailings on Algal Growth*

1. Algal growth rate was higher in 10% (16 mg/l particles $< 2u$) taconite tailings suspensions.
2. Increased growth rates are related to increases in soluble silica from the tailings and subsequent utilization by diatoms.

VI. The Dissolution of Taconite Tailings in Lake Superior

Conclusions:

1. In addition to the increase in soluble salts as the ore is processed, taconite tailings show continued solution after leaving the plant.
2. The rates of dissolution increase with decreasing concentrations of particles/unit volume of water and with increasing temperature.
3. After 332 days, increases in soluble components from tailings in Lake Superior water under simulated lake conditions were:

Component	Increase in mg/kg total tailings
SiO_2	331
Na	37
K	7
Ca	282
Mg	11
SS	61
TDS	1110

*Note: This hypothesis and its proof were clearly set forth in studies by Prof. Louis G. Williams, Biology Department of the University of Alabama, formerly of the National Water Quality Laboratory staff in Duluth. At the time he advanced his evidence, Dr. Williams became so controversial pressure

Commercial and sport fishermen have contended that schools of fish are not present in the "green water" and to catch fish at all they must go beyond the edge of this cloudy suspended material. Reserve has given no proof that this harm to commercial fishing has not taken place.

The state of Minnesota's 1947 permit to Reserve clearly states that "such tailings shall not be discharged so as to result in any material clouding or discoloration of the water outside of said zone" (1 1/2 miles from point of discharge) "except as caused by natural turbidity." Minnesota has likewise adopted water quality standards (approved by the Secretary of Interior) on turbidity and suspended solids which puts Reserve in clear violation. Reserve is challenging these standards in court.

CONCLUSION - The scientific evidence clearly points to the fact that Lake Superior is being irreparably damaged by Taconite tailings which are causing basic changes in the lake leading to eutrophication. The only question left is how can these tailings be disposed of harmlessly - not whether.

DISPOSAL ALTERNATIVE - Three federal pollution control conferences have been held in Duluth, Minnesota (May and September 1969 and April 1970) at which the above evidence has conclusively proven that many of Reserve's contentions are false. Secreatry of Interior Hickel has corroborated Secretary Udall's earlier recommendation for enforcement action. Reserve's reply is to challenge the evidence in court, to drag out the decision by procedural hearings and by the presentation of false estimates of the actual cost of alternative disposal methods.

All other taconite ore reducing plants, except Reserve's, pump their tailings through pipelines in a water suspension to stilling or settling basins in large ponds diked on the sides - in which the tailings settle out and the clean water is recycled through the processing plant over and over again. None of this turbid water reaches inland rivers or lakes. These plants make this waste disposal process a part of their regular production costs and capital investments.

Reserve has a substantial cost advantage over other companies by its lake dumping program. But the people of the United States and Canada are paying the price in a deteriorating body of water.

In 1968 the U. S. Bureau of Mines made a cost estimate - both capital and operating - of an on-land disposal system utilizing a valley (Lax Lake) behind the village of Silver Bay where tailings could be pumped into a dammed up stilling basin. This study was followed two years later by a series of consultant's studies combined into Engineering Task Force Program Report, Reserve Mining Co. April 7, 1970. In the latter instance, 19 different methods were reported - one of which included the Lax Lake one.

(Note from pg. 5 cont.) was put on him to leave the laboratory.

The cost estimates for the process in the same (Lax Lake) area varied so grossly from the Bureau of Mines figures as to make the validity of all 19 seriously suspect. The cost figures of the other proposed alternatives such as haul-back to the mines, pumping fines to the bottom of Lake Superior or to the Lax Lake area are being privately challenged by engineers who are familiar with the problem. Since Reserve presents its breakdown of cost elements or unit costs, impartial analysis by objective experts is the only method available to reach sound conclusions.

The Bureau of Mines has made some of its cost data available and will provide all background data. It is not known whether Reserve will supply such information for independent scrutiny. At the time of this study the Bureau of Mines reported that it had access to prime engineering cost estimates furnished from comparible situations - dam construction by the U. S. Army Corps of Engineers (St. Paul District Office) and pipelines from coal slurry installations in Applachia.

ANALYSIS OF THE BUREAU OF MINES PROPOSAL

In its portion of the U. S. Department of Interior 1968 study of Reserve's taconite waste disposal problems, the U. S. Bureau of Mines reported the following in its section - Pumping Cost Estimates:

> 1. Disposal of tailings in a pond as near the plant as possible would be the least costly alternative to depositing tailings in Lake Superior. The Bureau of Mines concludes that haul-back of tailings to areas mined out would not be possible because there are no such areas available yet.
>
> 2. The Bureau of Mines preliminary cost estimate indicates the most economic site would probably be in the area just northwest of the Reserve Plant. (valley below Lax Lake see topographic map)
>
> 3. Preliminary cost estimates included construction of a dike. (see insert C)
>
> 4. (see insert D)

Cost Analysis

The Bureau of Mines estimates of $3,300,000 per year for disposal amount to 33¢ per ton of taconite produced (10 million tons per year). On a daily basis of 30,000 tons, the on-land tailings disposal cost would cost around $10,000. If taconite ore production costs are about 12 dollars per ton at the lake dock, 33¢ is equivalent to an increase in production costs of less than 3%. All other plants in the industry must meet this expense of recycling tailings waste, and there are substantial reasons why the $350 million dollar Reserve plant at Silver Bay can meet this small added cost without serious financial disruption: (see page 10 for reasons)

Insert C.

"The preliminary cost estimates, tables 9 and 10, were prepared without benefit of any field work. It was assumed that construction materials are available nearby, that no unusual dike or foundation conditions exist, and that power for operation of the pumping facilities is available. No provision for emergency discharge of tailings in case of a power failure or freezing of tailings lines is included, the assumption being that an emergency spilling of tailings into Lake Superior would be permitted.

TABLE 9. Preliminary cost estimates of dike construction [1] *

Top elevation (mean sea level)	Soil dike (cubic yards)	Total cost soil dike	Rock dike (cubic yards)	Total cost rock dike
1150	5,000,000	$ 6,250,000	1,300,000	$ 4,550,000
1200	9,000,000	11,250,000	3,000,000	10,500,000
1250	25,000,000	31,250,000	8,000,000	28,000,000
1300	55,000,000	68,750,000	20,000,000	70,000,000

[1] Estimate by St. Paul District Crops of Engineers.

"Figure 2 shows the areas and dike locations of possible tailings ponds built to top elevations of 1150 and 1300 feet. The areas inundated range from 2 to 12 square miles. The approximate quantities of tailings that can be held at various top elevations are as follows:

DPM Height	Capacity	Years Useful Life-form
1150 feet	55 million long tons	3
1200 "	280 " " "	14
1250 "	715 " " "	36
1300 "	1,400 " " "	70

Dividing each capacity by 20 million long tons per year will give the approximate length of time required to fill the tailings pond to each elevation.

* No estimate of land cost of investment return is included.

Insert D.

"In addition to dike construction, provision would have to be made for handling the large runoff from spring floods. This would require spillways, rerouting the natural drainage, or pond capacity to hold the floods. If the overflow from the tailings pond was unacceptable as discharge into the natural drainage, additional facilities would be required to return the overflow to the plant for reuse. These items were not included in the cost estimate.

TABLE 10. Preliminary cost estimate of pumps, pipeline and thickener[1]

Distance (miles)	Vertical lift (feet)	Total capital investment	Component costs		
			Pumps	Thickener	Pipeline
3 1/2	600	$2,984,900	$1,493,700	$1,104,400	$386,800
4 1/2	700	3,371,900	1,770,300	1,104,400	497,200

"Summary of preliminary cost estimate of pumping and containing Reserve tailings:

Capital costs	
Initial dike work to elevation 1150	$ 4,500,000
Initial pipeline, pumps and thickener	3,000,000
Total initial investment	$ 7,500,000
Operating Costs (yearly)	
Pumping	$ 2,000,000
Average yearly dike rise requirements	1,300,000
Yearly total	$ 3,300,000

In Summation

The above proposal would pump the tailings in water up to the contained settling basin where they would settle out and the water would be recycled through the Reserve plant at Silver Bay to repeat the process. The annual operating and investment depreciation cost of $3,300,000 compares favorably with other taconite plants and places no undue burden on Reserve.

---

[1] Estimate by Bureau of Mines Process Evaluation Group, Morgantown, West Virginia.

1. The company has had 14 years of operation during which substantial savings in production costs have been enjoyed without waste treatment. (10,000,000 tons per year of 33¢ ton is equivalent to $3,300,000 or $10,000 per day. These savings to Reserve have been at the expense of the environment of all U. S.

2. The plant had been operating for a period long enough to enjoy substantial depreciation. Reserve has been able to write off about 80% of the original investment.

3. Under the very favorable tax structure for taconite companies in Minnesota, guaranteed for 25 years with passage of the Taconite Amendment in 1964, Reserve has enjoyed Substantial tax savings unavailable to non-taconite companies.

4. And finally, the financial position of both parent companies, Armco and Republic Steel, shows an excellent profit situation over the past decade since the Silver Bay plant began operations. According to Ernst & Ernst, Certified Public Accountants for Republic Steel, and Haskins and Sells, Armco's accounting firm, the financial reports showed retained net income, after dividends paid to stockholder and after taxes, as follows (in millions of dollars for the past 7 years:

	1969	1968	1967	1966	1965	1964	1963
Armco	$45,729	$45,000	$26,172	$42,326	$49,097	$35,976	$21,453
Republic	39,228	38,562	39,665	60,167	45,749	40,765	24,003
Total in millions of dollars	$84,957	$83,562	$65,837	$102,483	$94,846	$76,741	$45,456

Note: Retained net income (in capital surplus) is available to construct work disposal facilities without requiring any borrowing.

Conclusion

It is evident from the above facts that both the investment and operating cost for disposing of the taconite waste on upland basin impoundments are very modest and will not impair the economic position of the Silver Bay plant. Both parent companies can begin to discharge their "corporate-citizen" duties regarding the environment of Lake Superior by facing up to their responsibilities without further delay. This analysis shows that both corporate owners of the captive Reserve Company are in excellent financial positions to assume this added expense out of retained surplus without affecting either cost of production or stockholder dividends.

On numerous occasions Reserve has evinced great concern over the damage which will be done to the environment of Lax Lake area from a tailings settling basin. It has tried to throw fear into the residents of Silver Bay over the dangers of such a basin in the valley above the town. Only the lower end of the valley below Lax Lake would be affected - a little used area. Reserve's concern over its environmental impacts must be of very recent origin since there was no such concern shown over its profitable stripping of thousands of acres in the Babbit environment to produce taconite. It left a landscape there not dissimilar to that of the moon.

The damage done to this small Lax Lake area must be compared to the huge environmental damage now being done to Lake Superior. As for the hazard posed by a dam above the town, such a statement is nonsense. The dam will hold little water; the water will be re-circulated through the plant with only the settled tailings staying behind the dam. They produce no hazard whatsoever.

RESERVE'S DISPOSAL ALTERNATIVES

As the result of a federal and state directive given at the September, 1968 Water Pollution Control Conference in Duluth, Reserve Mining Co. hired a number of counseling firms to consider and analyze 19 different systems for disposal of its tailings. Several of the firms are well known and of sound reputation - others are not known by those in the iron and steel industry who make a business of constructing taconite tailings disposal systems.

Because of the "closed society" of mining engineers and the reprisals which would result against any individual in the industry who would publicly comment on Reserve's Engineering Task Forces Progress Report, it is necessary to withhold the names of those knowledgeable engineers who provided solid factual analysis for this report.

In their considered opinion, Proposal #1, and the supporting data provided in the Reserve report do not warrant serious consideration. The engineers challenge all of the figures presented as being completely out of line and not supportable in cost estimating. In their opinion, the difference between the Bureau of Mines' estimates and that of Trygve Hoff and Associates is completely impossible since no cost breakdown is given to show the sources of data. One engineering firm with a world wide experience in steel and taconite plant construction indicated that: 1) it could make money in constructing the tailings disposal system, prepared and at the cost estimated by the Bureau of Mines and, 2) that it could build a whole new 7,000,000 ton per year (Reserve is 10,000,000) plant at the cost shown by Reserve for the Lax Lake disposal area ($195 million).

Most of the other proposals are truly more costly (even with realistic data) than the Lax Lake proposal #1 or fail to handle the tailings effectively. Therefore, serious pursuit of detailed analysis is an exercise in futulity - especially since no unit or other cost details are given.

CONCLUSION

It is apparent that Reserve Mining Company has no serious intention of finding an alternative disposal system to prevent further pollution of Lake Superior. This conclusion is reluctantly drawn from the following evidence:

1. It used political pressure to try to suppress the original Interior Report.

2. When that failed, it used public criticism to try to discredit the Interior report and to gain "modification" of FWPEA's April 1969, report.

3. At the May 1969, Water Pollution Control Conference Reserve denied polluting the Lake in spite of solid evidence provided.

4. After the state of Minnesota's Pollution Control Agency was forced by the court action brought by MEIC and the Sierra Club to hold a hearing on the evidence of state permit violation, Reserve sought to delay the hearing by its own court action.

5. Reserve also took the Minnesota P.C.A. to court to prevent application of Lake Superior water quality standards on turbidity (the evidence showed over 800 times the maximum allowable suspended sediment.)

6. After being ordered by the Pollution Control Agency to produce some proposals for alternative disposal of its tailings, Reserve produced the completely irrelevent document mentioned above.

7. A substantial part of an honest effort and investment in a realistic tailings disposal system could have been paid for with the funds used by Reserve to buy advertising, to hire expensive legal talent, for public relations companies, and to hire easily manipulated "scientists."

8. Reserve has embarked upon a course of public defiance to save $4,300,000 per year (11,500 per day of 365) by continuing to pollute Superior rather than to live as a "good corporate citizen" by removing its pollutants.

####

MR. STEIN: Yes.

WILLIAM G. LEPTHIEN, MAJOR
CIVIL ENGINEER
K. I. SAWYER AIR FORCE BASE
MICHIGAN

MAJOR LEPTHIEN: I am Major Lepthien, Civil Engineer, K. I. Sawyer Air Force Base.

We have submitted a time schedule. Our study completion by the Environmental Health Lab will be 16 September. This they have promised us.

OSD will have to determine who will be the design and construction agency, and we hope to get a determination in October. We hope to have an A and E contractor by December.

We are talking this year's time frame. Dependent on Congress appropriation, an initial estimate of the study which Major Elliott gave us was about $952,000 for its military construction program. If Congress can fund us, we will be done in 1971.

MR. STEIN: Thank you for that statement.

MAJOR LEPTHIEN: Now, these are variables that are beyond the Base control, are dependent on variables quite beyond the Base control.

MR. STEIN: By the way, as you no doubt know, at least speaking for myself, I am an old-time bureaucrat who has been through all the steps, and no one is talking about Base responsibility here because we all recognize how the system works. And don't take this as a fact that someone is saying that the problem only rests with the Base personnel or the Base commander or the people who make determinations on any particular base. We all know that.

MAJOR LEPTHIEN: Very well. We feel that we have put forth a determined effort to rush this program through at base level, and our higher headquarters have also cooperated.

Thank you.

MR. STEIN: We will recess now. The conferees alone--and I hope you will keep your staff to a minimum--will reappear in Executive Session in the Forest Room at 2:15. Is that all right? And then we should be able to have a public statement, hopefully about 4 or 5 o'clock.

We will stand recessed.

(NOON RECESS)

AFTERNOON SESSION

THURSDAY, AUGUST 13, 1970

2:30 o'clock

MR. STEIN: Let's reconvene.

First I have a letter here from a very stubborn woman. You can emphasize the stubborn and I will emphasize the woman.

"Gentlemen: I asked to be placed on the agenda twice during the Lake Superior Conference. First, to present a statement on behalf of the Save Lake Superior Association, Inc., with chapters in Wisconsin, Michigan and Minnesota. That was an official position of the Association, but I would also like to state my own personal position.

"Public concern for Lake Superior is a major factor in your decision concerning Reserve Mining Company's discharge. Here today as well as during the trial in Lake County District Court, Two Harbors, Minnesota, it has been implied that public concern has somehow been initiated and motivated by reports from Dr. L. G. Williams and Mr. Charles Stoddard. It has also been implied that I as an opinion leader have based my concern upon these reports. The contrary is true.

"Gentlemen"--and I appreciate that, Mrs. Harvell--"until a few weeks before the first convening of this conference May 13 to 15, 1969, I had to my knowledge never heard of these men." I am glad you put that "heard." "As a strong opinion leader in this issue I want you to know what I base my concern upon. Namely, my own personal eyewitness observations of the changes in Lake Superior.

"Gentlemen, I was born and raised on the shores of Lake Superior. I grew up in intimacy with this lake."

Mrs. Harvell, do you know where I was born and raised? In South Brooklyn. And I would hate to tell you who I was brought up in intimacy with. (Laughter.)

"Prior to 1957, I had never seen green water in Lake Superior, nor had I ever seen slimey algal growth along the cliff faces of the lake. The changes in this lake over the past at least three to eleven years to my knowledge, have been alarming. The changes are not pleasing. They are alarming. My own personal observations point out the fact that the source of the discoloration in Lake Superior, which most term 'green water', is from the delta at Reserve Mining Company.

"So, gentlemen, before you make a decision that might be colored by the implications that public opinion is based or predicated on reports by Mr. Stoddard or Dr. Williams, please take into consideration these facts.

"I know from personal observation that the discoloration of Lake Superior adjacent to the shoreline from Silver Bay to as far away as Knife River and Duluth is being accelerated and to the most part caused by Reserve Mining Company.

"I also feel that you should know that my persistence in this matter will continue"--I never had any doubts about that, Mrs. Harvell--"though I fear that the tailings will be affecting Lake Superior long after I have passed on."

I hope that day never comes.

Signed "Mrs. Arlene Harvell."

(Which letter follows:)

Save Lake Superior Association

TO PREVENT THE POLLUTION OF LAKE SUPERIOR

MRS. ARLENE HARVELL,
E. Star Rte., Box 117
Two Harbors, Minn. 55616

Executive Director

August 13, 1970

Gentlemen: I asked to be placed on the agenda twice during the Lake Superior Conference. First, to present a statement on behalf of the Save Lake Superior Association, Inc., with chapters in Wisconsin, Michigan and Minnesota. That was an official position of the Association, but I wouldalso like to state my own personal position.

Public concern for Lake Superior is a major factor in your decision concerning Reserve Mining Company's discharge. Here today as well as during the trial in Lake County District Court, Two Harbors, Minnesota, it has been implied that public concern has somehow been initiated and motivated by reports from Dr. L.G. Williams and Mr. Chas. Stoddard. It has also been implied that I as an opinion leader have based my concern upon these reports. The contrary is true.

Gentlemen, until a few weeks before the first convening of this Conference, May 13-15, 1969, I had to my knowledge never heard of these men. As a strong opinion leader in this issue I want you to know what I base my concern upon. Namely, my own personal eyewitness observations of the changes in Lake Superior.

Gentlemen, I was born and raised on the shores of Lake Superior. I grew up in intimacy with this Lake. Prior to 1957, I had never seen green water in Lake Superior, nor had I ever seen slimey algal growth along the cliff faces of the L Lake. The changes in this Lake over the past at least three to eleven years to my knowledge, have been alarming. The changes are not pleasing. They are alarming. My own personal observations point out the fact that the source of the discoloration in Lake Superior, which most term "green water", is from the delta at Reserve Mining Company.

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I know from personal observation that the discoloration of Lake Superior adjacent to the shoreline from Silver Bay to as far away as Knife River and Duluth is being accelerated and to the most part, caused by the Reserve Mining Co.

I also feel that you should know that my persistence in this matter will continue, though I fear that the tailings will be affecting Lake Superior long after I have passed on.

Mrs Arlene I Harvell

MR. STEIN: We also have Mr. Carson. Would you like to make your statement now, sir?

DR. CHARLES CARSON
WATER RESOURCES CO-CHAIRMAN
MINNESOTA ENVIRONMENTAL CONTROL CITIZEN'S ASSOCIATION
RIVER FALLS, MINNESOTA

DR. CARSON: Mr. Chairman, members of the conference, ladies and gentlemen.

I represent MECCA or the Minnesota Environmental Control Citizen's Association, 26 East Exchange, St. Paul, Minnesota. The staff of MECCA has prepared a summary of some of the findings to date and also an economic analysis, and I would like to just briefly summarize some of this material. I think the conferees have it.

Beginning on page 7--

MR. STEIN: Mr. Carson, we will put, without objection, your full statement in the record as if read.

(Which statement appears herein at pages 674 to 686, inclusive.)

DR. CARSON: That will be fine. I don't want to take up the time of the conference with the entire statement; it is about 12 pages long. I thought I would just summarize some pertinent parts of it and then make some comments of my own, if that would be all right.

O.K.?

MR. STEIN: Go right ahead.

DR. CARSON: On page 7 of this MECCA report we have an analysis of the Bureau of Mines proposal.

> In its portion of the U. S. Department of Interior 1968 study of Reserve's taconite waste disposal problems, the U. S. Bureau of Mines reported the following in its section - Pumping Cost Estimates:
>
> 1. Disposal of tailings in a pond as near the plant as possible would be the least costly alternative to depositing tailings in Lake Superior. The Bureau of Mines concludes that haul-back of tailings to areas mined out would not be possible because there are no such areas available yet.
>
> 2. The Bureau of Mines preliminary cost estimate indicates the most economic site would probably be in the area just northwest of the Reserve Plant.
>
> 3. Preliminary cost estimates

included construction of a dike.

On page 9 here, there is a summary of what the Bureau of Mines estimated the capital costs and operating costs would be to Reserve for the construction of this sort of facility.

The initial dike work to elevation 1150 feet would be $4.5 million. The initial pipeline, pumps and thickener, $3 million. The total investment, then, the initial capital investment would be $7.5 million.

The operating costs on a yearly basis would be: For pumping, $2 million. The average yearly dike rise requirements, $1.3 million. For a yearly total, then, operating costs of $3.3 million.

In summation, then:

> The above proposal would pump the tailings in water up to the contained settling basin where they would settle out and the water would be recycled through the Reserve plant at Silver Bay to repeat the process. The annual operating and investment depreciation cost of $3.3 million compares favorably with other taconite plants and places no undue burden on Reserve Mining.

On page 10 the report continues:

1. The company has had 14 years of operation during which substantial savings in production costs have been enjoyed without waste treatment. Ten million tons per year at 33 cents per ton is equivalent to $3.3 million or $10,000 per day. These savings to Reserve have been at the expense of the environment of the United States.

2. The plant has been operating for a period long enough to enjoy substantial depreciation. Reserve has been able to write off about 80 percent of the original investment.

3. Under the very favorable tax structure for taconite companies in Minnesota, guaranteed for 25 years with passage of the Taconite Amendment in 1964, Reserve has enjoyed substantial tax savings unavailable to non-taconite companies.

4. And finally, the financial position of both parent companies, Armco and Republic Steel, shows an excellent profit

situation over the past decade since the Silver Bay plant began operations. According to Ernst & Ernst, Certified Public Accountants for Republic Steel, and Haskins and Sells, Armco's accounting firm, the financial reports showed retained net income, after dividends paid to stockholders and after taxes, as follows, in millions of dollars for the past seven years:

And for 1969 that total for Republic and Armco is $84,957,000 retained net income capital surplus.

The conclusion is as follows:

It is evident from the above facts that both the investment and operating cost for disposing of the taconite waste on upland basin impoundments are very modest and will not impair the economic position of the Silver Bay plant. Both parent companies can begin to discharge their "corporate-citizen" duties regarding the environment of Lake Superior by facing up to their responsibilities without further delay. This analysis shows that both corporate owners of the captive Reserve Company are in excellent financial positions to assume this added expense out of retained surplus without affecting either cost of production or stockholder dividends.

On numerous occasions Reserve has evinced great concern over the damage which will be done to the environment of Lax Lake area from a tailings settling basin. It has tried to throw fear into the residents of Silver Bay over the dangers of such a basin in the valley above the town. Only the lower end of the valley below Lax Lake would be affected, a little used area. Reserve's concern over its environmental impact must be of very recent origin, since there was no such concern shown over its profitable stripping of thousands of acres in the Babbitt environment to produce taconite. It left a landscape there not dissimilar to that of the moon.

The damage done to this small Lax Lake area must be compared to the huge environmental damage now being done to Lake Superior. As for the hazard posed by a dam above the town, such a statement is nonsense. The dam will hold little water; the water will be recirculated through the plant with only the settled tailings staying behind the dam. They produce no hazard whatsoever.

There are, then, several disposal alternatives that Reserve has made:

As the result of a Federal and State directive given at the September 1969 water pollution control conference in Duluth, Reserve Mining Company hired a number of counseling, or consulting, firms to consider and analyze 19 different systems for disposal of its tailings. Several of the firms are well known and of sound reputation. Others are not known by those in the iron and steel industry who make a business of constructing taconite tailings disposal systems.

Because of the closed society of mining engineers and the reprisals which would result against any individual in the industry who would publicly comment on Reserve's Engineering Task Forces Progress Report, it is necessary to withhold the names of those knowledgeable engineers who provided solid factual analysis for this report.

In their considered opinion, Proposal No. 1, and the supporting data provided in the Reserve report do not warrant serious consideration. The engineers challenge all of the figures presented as being completely out of line and not supportable in cost estimating. In their opinion, the difference between the Bureau of Mines estimates and that of Trygve Hoff and Associates is completely impossible since no cost breakdown is given to show the sources of data. One engineering firm with a world-wide experience in steel and taconite plant construction indicated that: 1) it could make money in constructing the tailings disposal system prepared at the cost estimated by the Bureau of Mines, and 2) that it could build a whole new 7 million ton per year plant at the cost shown by Reserve for the Lax Lake disposal area, the cost estimated at $195 million.

The conclusion, then, of the MECCA statement is:

C. Carson

It is apparent that Reserve Mining Company has no serious intention of finding an alternative disposal system to prevent further pollution of Lake Superior. This conclusion is reluctantly drawn from the following evidence:

1. It used political pressure to try to suppress the original Interior report.

2. When that failed, it used public criticism to try to discredit the Interior report and to gain "modification" of the FWPCA's April 1969 report.

3. At the May 1969 water pollution control conference Reserve denied polluting the lake in spite of solid evidence provided.

4. After the State of Minnesota's Pollution Control Agency was forced to the court action brought by MEIC and the Sierra Club to hold a hearing on the evidence of State permit violation, Reserve sought to delay the hearing by its own court action.

5. Reserve also took the Minnesota PCA to court to prevent application of Lake

Superior water quality standards on turbidity. The evidence showed over 800 times the maximum allowable suspended sediment.

6. After being ordered by the Pollution Control Agency to produce some proposals for alternative disposal of its tailings, Reserve produced the completely irrelevant document mentioned above.

7. A substantial part of an honest effort and investment in a realistic tailings disposal system could have been paid for with the funds used by Reserve to buy advertising, to hire expensive legal talent, for public relations companies, and to hire easily manipulated "scientists."

8. Reserve has embarked upon a course of public defiance to save $4.3 million per year.

I have some remarks of my own.

There are, it seems to me from what I have heard here the last day or two, three major questions.

No. 1--of course, we have been over this 50,000 times before--is there pollution in Lake Superior?

It seems from what Dr. Mount, especially, has had to say, and others, that there is no question that Reserve's tailings are a pollutant in the lake. If they serve as the low side for cancer, as the low side for bacterial accumulation in the lake, that is something that will lead in part to eutrophication. If they put a great deal of phosphorus in the lake, while we can debate all day long how much of that is available, certainly some of it is, this is a factor which will increase the nutrient level in the lake and MECCA's position is that there is water pollution in Lake Superior from Reserve's operation.

The second thing that seems to be a question is, is this, then, an interstate problem? In other words, is the pollution, is the material, from Reserve's operation carried interstate? And here is another thing, of course, that can be debated. There is a lot that I think can be shown beyond a shadow of a doubt that these things are carried interstate.

If I can use the blackboard for a minute, I would like to show why that is.

Now, if a study is made of the wind averages, the directions and velocities in this region from weather bureau records, which go back for a long ways, I don't know how far, but I am sure quite some years, it can be shown that the maximum storm direction is about east to northeast. This means that the long shore flow in Lake Superior moves something like this (drawing on blackboard), with return spirals out here. So that anything you put in the lake here at Silver Bay will eventually go down the shore and return into Michigan and Minnesota waters eventually.

Now, this kind of system exists primarily during the most vigorous winds, but since Lake Superior is so large and since there is quite a bit of inertia involved in this sort of thing, even on relatively calm days this kind of circulation persists. In a 20- or 25-mile an hour wind you can calculate that the velocity of these currents will be on the order of 2 to 8 or 9 miles an hour.

MR. STEIN: Mr. Carson, you recognize we put you on out of order. You said you were going to summarize your statement. I hope this is a summary.

DR. CARSON: That is right. I would like to make a few extra remarks if I might.

MR. STEIN: No. Will you continue? I hope you will give us the same courtesy we gave you.

DR. CARSON: I will make it as brief as I can. But there is some question that has been raised here as to whether or not there is a valid scientific basis for some of these statements, and I would like to proceed to show that there is.

In the geophysical union transactions for 1949 you will find there a paper from Scripps Institution of Oceanography in which it can be shown or which shows on the basis of experiments that the velocity of these currents can be calculated very accurately. In case you want to copy it down, here it is (writing on blackboard). I can tell you what each of those terms mean if you want me to and work it out for you.

But in a 20- or 25-mile an hour wind the current in Lake Superior will be on the order of 3 to 8 or 9 miles an hour, and it will persist even in much lower velocity. So I don't think there is any doubt that this stuff is carried interstate. It can be proven, and if you would like it proven I will be glad to do so.

The third thing, then, the major question is, is there any danger, any clear and present danger, to the health and welfare of people interstate. Well, no one has died yet from this, so if we want that for a definition, certainly it is true that there has been no--there is no clear and present danger.

I would like to say this in closing, just as a general remark. There are very basic things in operation here. Reserve in a sense is a classic case. I have nothing against that company. I am only interested in lakes, and I am very tired, incidentally, of appearing at these things because it really does no good. But there are some very basic problems involved here. We have seen outside today, in the last two or three days, an example that is just a little harbinger of what is coming. And what is basically involved in all of these problems is two or three things.

We have to make some decisions about whether or not we are going to take action before it is too late. This is a different type of thing than most problems that conferences of this sort and other legal entities run into, because some of the things that happen environmentally are irreversible and they are just not going to be correctible in any reasonable length of time.

So the way in which we look at these problems has got to be a little different.

The second thing is that we have a habit in this country of providing an unnamed subsidy for industry which really amounts to environmental damage. That is the subsidy which many industries receive.

The third thing is public apathy. People don't care about this. They have got their beer and their television and their Mustangs and there is no need, most of them think, to give this environmental problem any concern. Well, I could show you why there is a very great need to do so. I am not going to bother.

And the final thing which is very crucial is that most of the corporate power in the United States is in the hands of people between 60 and 70 years of age, and many of these people believe that since they will not be here to pay the bill, therefore it is not important to worry about.

I fully expect, I think really, that scientific accuracy and possibly legal accuracy has been made a mockery of in this particular issue, and I fully expect that five years from now Reserve will still be putting their tailings into Lake Superior.

That is all I have to say.

MR. STEIN: Thank you for your vote of confidence, Mr. Carson. (Laughter.)

MR. FRANGOS: Mr. Stein, I have a question, please.

MR. STEIN: Yes.

MR. FRANGOS: I just ask for the record to have an indication in what capacity this statement is made. Is it made in the capacity of an ecologist, a geologist, a political scientist, or in what capacity do we receive this expert testimony?

DR. CARSON: I am a geologist. I am a Fellow of the Geological Society of America. I am Associate Professor at Wisconsin State University in River Falls. And I am a member of the Board of Directors of MECCA and also Chairman of its Policy Committee.

MR. FRANGOS: That is a State university, sir?

DR. CARSON: Yes.

MR. FRANGOS: Subsidized by the State of Wisconsin?

DR. CARSON: And the Federal Government.

MR. FRANGOS: I see. All right, thank you.

MR. BADALICH: Mr. Chairman.

MR. STEIN: What isn't subsidized by the Federal Government? (Laughter.)

Go ahead.

MR. BADALICH: Mr. Chairman, I wouldn't want Dr. Carson to leave. I also thank you for the vote of confidence, Mr. Carson or Dr. Carson.

But in your statement here on page number 10, do you really mean those figures, on page number 10 those figures that you have listed in this table?

DR. CARSON: Yes.

MR. BADALICH: I am only an engineer, I am not a scientist--

DR. CARSON: Now, this is on page--

MR. BADALICH: --but I think your figures in total millions, is this right, that it is going to cost $84 billion?

DR. CARSON: No, this is supposed to be $84 million. There may have been an error here.

MR. BADALICH: You have a comma in place of the decimal.

MR. STEIN: The way you have it is $84 billion.

DR. CARSON: I am sorry. I said $84 million, didn't I, in my remarks?

MR. STEIN: No, you wrote $84 billion.

DR. CARSON: No, I meant $84 million and I said that orally.

MR. STEIN: What?

DR. CARSON: I made that statement $84 million.

MR. STEIN: In other words, you are correcting your written statement orally?

DR. CARSON: Yes.

MR. STEIN: All right, we are glad to accept that.

MR. BADALICH: And then, Mr. Chairman, if I may ask, on page number 12, Dr. Carson--

DR. CARSON: Yes.

MR. BADALICH: --to keep the record straight on who these people are, I would like to know who the manipulated scientists are.

DR. CARSON: Well, we heard, for one thing, today Mr. Lee say or imply that Reserve's operation was improving the quality of the lake as far as bacterial count is concerned. The implication there is, then, that this is a beneficial thing.

MR. BADALICH: Then in turn, you are challenging his credentials?

DR. CARSON: Well, I don't know as you can challenge his credentials. I would challenge his statement.

MR. BADALICH: Why do you say he is manipulated?

DR. CARSON: I am not saying that Mr. Lee is manipulated. I think that testimony--

MR. BADALICH: You said that in your statement.

DR. CARSON: I didn't say Mr. Lee is manipulated.

MR. BADALICH: Yes, you did.

DR. CARSON: No, I didn't.

MR. BADALICH: You just said it.

DR. CARSON: I said an example of this kind of testimony was given here today. Now, whether or not he is manipulated as such on all issues, it is hard to say.

But I think this about scientific testimony. You can get anybody to testify to anything. And I suppose if you paid me enough, I would come out for Reserve.

MR. BADALICH: Well, thank you. I think that is a very good clarification of your testimony. (Laughter.)

MR. PURDY: Who is paying him for this?

MR. STEIN: Any more statements?

I have one remark here. You said Reserve has hired expensive legal talent. They may be expensive legal talent, but on the basis of experience I can say they are sorely underpaid. (Laughter.)

DR. CARSON: Well, may be. I don't know what they pay Mr. Fride. He is certainly a good lawyer.

MR. STEIN: Or anyone else.

Are there any other comments or questions?

If not, thank you.

MR. PURDY: Mr. Stein, the oral report, and also the written report, dwells at length on the Bureau of the Mines proposal, and I am wondering if this is simply a restating of what has already been placed in the record by others or if by its inclusion in this statement it indicates that this has been separately reviewed by the doctor now and that he concurs in these costs.

Have you separately reviewed--

DR. CARSON: That is right.

MR. PURDY: --the cost analysis made by the Bureau of the Mines and do you concur in it?

DR. CARSON: The staff of MECCA has reviewed this and I have reviewed it with them and this is our conclusion, yes.

MR. STEIN: Are there any other comments or questions?

If not, the following statement was mailed to me for inclusion in the record as if read:

Federal-State Enforcement Conference on Lake Superior
Mr. Murray Stein, Conference Chairman
Federal Water Quality Administration
Enforcement Division
Washington, D.C.

Dear Mr. Stein:

The following statemeng is submitted for inclusion in the reconvened Federal-State Enforcement Conference on Lake Superior, Duluth Minnesota, August 12-13, 1970. I hope to be present at the conference and, if permitted, would be pleased to make this statement personally. In any event, I would like it to be made a part of the record.

Sincerely yours,
C. Vernon Lake

C. Vernon Lake
6455 York Ave. So.
Minneapolis, Minn. 55435

STATEMENT

Mrs. Theodore Bergman (5400 Clinton Ave. So. Mpls.) and I jointly own forty-five acres of land along the shoreline between Silver Bay, Minnesota and Palisade head on the north shore of Lake Superior. Since 1938 it has been our custom to vacation annually in this area. Consequently our observations of and concern for developments in this region extend over a period of 32 years.

In recent years, particularly since the erection and operation of the Reserve Mining Company's taconite processing plant at Silver Bay, we have become anxiously concerned over qualitative changes in the area's environment. That things are not what once they were is obvious to anyone who has lived long enough to have a memory with reference to these matters. The lake bottom is over-laid with a moss-like, sludgy substance which roils the water when disturbed by wave action. Prevailing southwesterly winds fill our bay with the milky-green coloration that originates off the delta at the plant site. Garbage and debris from the ore carriers drift ashore upon our beach. The air is filled with fly ash. Tailings from the delta are gradually working their way along the shore, sanding in rock out croppings that once were picturesque islands surrounded by sky blue water. The foilage is not as dense as once it was. The municipal dump is becoming a visible eye-sore; and the fish have disappeared from formerly exciting trolling areas.

Coincidence is never proof, of course, and technical specialists may have difficulty agreeing upon a definition of pollution. But to my mind it seems at least plausible to suspect that the aforementioned unhappy and undesireable changes are the consequence of activities that center in the taconite processing plant at Silver Bay. Corporation executives, more recently come to the scene, are not convincing when they seek to reassure an apprehensive public by saying, "It's always been that way." We know differently.

The agreement of the recessed Conference was that at this one Reserve Mining Company would be required to make a report on alternate means of taconite tailings disposal. We were not happy with the decision to grant the Corporation this six months delay, for Reserve has been under the gun about this matter for years and it is difficult to believe they haven't already given it considerable thought. We suspect that management already knows what it intends to do and the postponement only gave it another six months before they had to tell us. We sincerely hope no further delays will be considered by this reconvened Conference.

The despoilation of nature is generally irreversible. What is done stays done, and can never be restored. It seems to us that the present size of the ugly scar on the North Shore is a sufficient memorial to man's poor judgment without permitting it to grow larger while decision is delayed.

We would support any plan that would halt, if not reverse, the deletorious processes now in operation along and around the shores of Lake Superior. Our stance is ecumenical. The hour has come in the technological history of man when he can no longer afford to subsidize any industry at the expense of his environment. To do so will bring the end of all history.

Respectfully yours,

C. Vernon Lake

C. Vernon Lake
6455 York Ave. So.
Minneapolis, Minn. 55435

MR. STEIN: If no one else wants to go, we have this problem before us. The Chairman is completely neutral on this.

We want to get the case solved and the question is how we have this Executive Session. Sometimes we have them closed; sometimes we have them in view of the public. Whatever the conferees want, that is what we are going to do. I think in view of the situation the people are entitled to know, at least, before we go into Executive Session how everyone feels.

I would like to poll the conferees on whether you want a closed Executive Session or an open Executive Session here.

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes.

MR. BADALICH: I think it has always been customary in the State of Minnesota that this will be a session open to the public. We will not go into a closed Executive Session.

MR. STEIN: I call on Michigan.

MR. PURDY: No objection.

MR. STEIN: Wisconsin?

MR. FRANGOS: No objection.

MR. STEIN: Federal conferee?

MR. MAYO: No objection.

MR. STEIN: Then we will proceed right now.

EXECUTIVE SESSION AND SUMMARY

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes.

MR. BADALICH: I have one interesting observation to make during the course of this hearing. I think there have been a lot of conflicting opinions that have been expressed, mostly by Dr. Mount and also by Dr. Lee, both of whom I feel are men of outstanding credentials. Professor Lee has commented at some length on other evidence presented at this hearing. He will also submit additional information and a comprehensive report within a few days.

Dr. Mount has not had a similar opportunity, although I am sure that he is entitled to an opportunity to refute the statement of Dr. Lee. Minnesota believes that the status of the evidence that is now before this conference shows that there is a high probability of interstate pollution. We would like the record to be legally complete, however, before making any finding.

We think Dr. Mount should be able to prepare his comments in response to Dr. Lee very shortly and submit them to us.* The conferees can then comment to the Chairman and he can take these comments into account when making his findings.

We see no necessity now to reconvene. We believe that this conference today should give Reserve a specific timetable on which way they should proceed and operate and submit alternate methods of tailings disposal.

MR. STEIN: All right, let me go there. We have one clear finding that I think we have to review here, and we will say there is presumptive evidence in the record to indicate that the discharges from Reserve Mining Company endanger the health or welfare of persons in States other than that in which such discharges originate and this pollution is subject to abatement under the provisions of the Federal Water Pollution Control Act. The key word here is "presumptive." The question here is whether the conferees want to eliminate that or not and say that there is evidence to indicate or there is evidence that there are discharges.

We didn't push this because this is not a hearing, but what is Dr. Lee's background? Do you know?

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*The conferees and Dr. Mount agreed that a supplemental statement by Dr. Mount was not necessary.

MR. BADALICH: I believe by his paper he is a professor in water chemistry.

MR. STEIN: Water chemistry. We had a variety of information on geology, biology, chemicals, chemotherapy, whatever-have-you. You can make your own judgment whether Dr. Lee is qualified to say this on the basis of his professional background and if he is qualified to do this.

I raise this question with you right now. Do you want to make the judgment that on the opinion of Dr. Mount, Dr. Shapiro, Dr. Goldman, Dr. Lee, and all the other information we have here--and I think this is the key question here--do you want to say that we can arrive at a conclusion that discharges from Reserve Mining Company endanger the health or welfare of persons in States other than that in which such discharges originate and that this pollution is subject to abatement under the provisions of the Water Pollution Control Act?

I place this question before the conferees.

MR. BADALICH: Mr. Chairman, I think that in all fairness to Dr. Mount, I would like to see his statement of rebuttal or his statement of concurrence in the statements made by Dr. Lee before we continue any further and have this part of the record.

MR. STEIN: Dr. Mount, are you here? Yes. Do you want to say anything about this? We would have had you in the Executive Session in any event.

DR. MOUNT: It is pretty tough in circumstances like this to really think clearly and carefully and be sure that everything one says is the way he wants to say it.

I think the most appropriate way to do this would be to give me a chance to make a written statement on this. Of course I can comment, but I am not sure that this would be as effective and fair as it would be in a written statement.

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes.

MR. BADALICH: I believe we afforded the opportunity to Dr. Lee to submit a statement within the next three days, and I think the same privilege should be given to Dr. Mount in this matter.

MR. STEIN: The question I am asking, do you feel you can't make this judgment now on the basis of the statements referred to? Do you think we need three more days to do this or do you think you can say this?

The clear question here is--and we have been sitting with this for a long time and I don't know that you are going to get any more information in three days; the conferees have this before them--can we decide that discharges from Reserve Mining endanger health or welfare of persons in another State?

Can you decide they do or don't or do you want to defer that? And I think you have to just state it.

MR. BADALICH: Well, Mr. Chairman, I would certainly like to see the comments of Dr. Mount before I make any conclusive evidence or take any--

MR. STEIN: In other words, you are not prepared to make a statement now?

MR. BADALICH: No, I don't think so, not at this time, if Dr. Mount feels that he can't make any comment at this time.

MR. STEIN: All right. How about the Federal conferee?

MR. MAYO: Mr. Chairman, with the background that the conferees have received in the course of the sessions of the conference, the material that has been submitted and offered to us for our consideration, in keeping with our public official responsibility with respect to the preservation and maintenance of the quality of Lake Superior, and I think in keeping with the intent of the Federal Statute, that we are obliged to give the broadest possible interpretation to the language and the intent of the Statute, and as the Federal Conferee I am prepared to state the conclusion that the discharge, in my opinion, does constitute an endangerment to the health or welfare of persons--

MR. STEIN: That is the discharge from Reserve?

MR. MAYO: From Reserve. --to persons in States other than that in which it takes place.

MR. STEIN: May we hear from Michigan?

MR. PURDY: Mr. Stein, with all due recognition to the differences in scientific opinion--and I am not sure how long we would have to leave the record open for a rebuttal because I don't know who should get the last word--I think that due prudence to preserve this high quality lake means that we at this time ought to reach some additional conclusion. I am not sure that I like the exact wording of No. 18 in the Summary. I think that I would prefer wording that would say that there is evidence in the record to indicate that discharges into Lake Superior from all sources endanger the health or welfare of persons in States other than that in which such discharges originate and that this pollution is subject to abatement under the provisions of the Federal Water Pollution Control Act.

MR. STEIN: May I suggest one statement? And I don't mean to single this out, but I think it is evident here we have to face reality. Do you want to say, "from all sources including Reserve Mining Company?"

MR. PURDY: This, of course, is intended by the "all sources." Again Reserve is not the only source.

MR. STEIN: We recognize that.

MR. PURDY: And if we say "including Reserve," why don't we say "including all," I mean name each one?

MR. STEIN: Well, we can name these sources if you want to, and I think we can produce all the sources, including Reserve. That may be the way to do it. What do you think of that?

MR. PURDY: I just didn't feel that it was necessary to single out an individual municipality or an individual industry.

MR. STEIN: This is an enforcement case. Why don't we say:

"There is evidence in the record that discharges from the following sources endanger", and then have a full list of those sources?

What do you think of that?

MR. PURDY: I think the record up to date is that the other sources have been specifically identified by the States as affecting Lake Superior, so the record shows the sources that we are talking about.

MR. STEIN: I don't see that there is any problem here. I think the key problem here is the specificity. I don't want there to be any ambiguity in this that Reserve Mining is included or not, and the conferees can do as they wish on that, but I think the States and the conferees are all in agreement on the other sources.

Do you want to include Reserve Mining or not in these sources? Now, we can say that "there is evidence in the record to indicate that discharges from sources already specifically named by the conferees, including Reserve Mining, endanger."

MR. PURDY: O.K.

MR. STEIN: All right.

Wisconsin?

MR. MACKIE: We would agree to that, Mr. Chairman.

MR. STEIN: All right.

MR. PURDY: Mr. Stein, in doing this I think also that I would hope that the record would indicate and take recognition of the action that the State of Minnesota has taken in, say, attempting to enforce its standards.

MR. STEIN: I would certainly agree with that. Can't we leave that until later? I think Minnesota--and I am going to bring that up--I think Minnesota should be commended.

Let me see if I have this and let's see we have it.

"There is evidence in the record to indicate that the dischargers named by the conferees in their reports to the conference, including the Reserve Mining Company, endanger the health or welfare of persons in States other than that in which such discharges originate and this pollution is subject to abatement under the provisions of the Federal Water Pollution Control Act."

As I understand it, this statement is agreed to by Wisconsin, Michigan, and the Federal conferees, but not by the Minnesota conferee, that would like more evidence to be adduced before they make a judgment.

Is that the summary at the present time?

MR. BADALICH: Mr. Chairman, I believe if you name all the dischargers we will certainly go along with it.

MR. STEIN: You mean name them in a list?

MR. BADALICH: Yes. Why not? Let's have a laundry list.

MR. STEIN: All right. Is that agreeable?

All right, let me say:

"There is evidence in the record to indicate that the following dischargers", and we will list all the dischargers that Minnesota named--and, of course, this includes Reserve, because you listed them, right?

MR. BADALICH: Absolutely.

MR. STEIN: --all the dischargers that Wisconsin named and all the dischargers that Michigan named "endanger the health or welfare of persons in a State other than that in which such discharges originate and this pollution is subject to abatement under the provisions of the Federal Water Pollution Control Act."

MR. BADALICH: Mr. Chairman, include the Federal installations also.

MR. STEIN: Yes.

MR. BADALICH: All right.

(Laughter.)

MR. STEIN: As a matter of fact, if your ingenuity can invent this and complacency can permit it, I suggest we put them first. (Laughter.) No question of that.

Is that agreeable to you?

MR. MAYO: That is agreeable to me, Mr. Chairman.

MR. BADALICH: That is agreeable to the Minnesota conferees, Mr. Chairman.

MR. STEIN: All right.

Now let's go to No. 2.

We have dates reported for all other people. Can we say next that we "commend the Minnesota Pollution Control"-Agency, is it, or Administration? Agency.

MR. BADALICH: Agency.

MR. STEIN: "--Agency for its active water pollution control and abatement program, particularly--

for its active water pollution control program, including its willingness to go to court where necessary to secure abatement. In addition, the conferees wish to commend the pollution control abatement programs of Michigan, Wisconsin, Minnesota, and their reporting systems are commended and the conferees believe that the States have active programs to secure abatement of all sources of pollution to Lake Superior."

Is this agreeable?

MR. MACKIE: Why don't you just read that through again?

MR. STEIN: Would you read that?

(Record read as follows:

"Can we say next that we commend the Minnesota Pollution Control Agency for its active water pollution control abatement program, particularly--for its active water pollution control program, including its willingness to go to court where necessary to secure abatement. In addition, the conferees wish to commend the pollution control abatement programs of Michigan, Wisconsin, Minnesota, and their reporting systems are commended, and the conferees believe that the States have active programs to secure abatement of all sources of pollution to Lake Superior.")

MR. STEIN: "And their reporting systems." All right. Is that agreeable? And we will clean up the grammar.

(No verbal response.)

The next point is I think we should give a special commendation to the members of the Technical Committee. I would recommend that we name those who prepared the report for water quality recommendations for consideration by the States and the Federal Government as water quality standards.

MR. MAYO: I would like to speak to that for a minute, Mr. Chairman. You might want to add something to it.

You recall yesterday when we discussed the recommendations of the water quality committee, Mr. Purdy read a statement into the record which involved the need for the States to move ahead with the holding of public hearings and the adoption of the recommended changes under the State standards. It also recommended that the individual States invite the Department of the Interior and other Federal agencies and the other States to participate.

I think it would be helpful, Mr. Chairman, to hold the Technical Committee in readiness to consult and be available to the individual States as they proceed with the recommended changes in their water quality standards.

MR. STEIN: Let me back up a moment. I think you have a good point.

Mr. Purdy, would you read that statement? Do you have it--the one that you made yesterday?

MR. PURDY: The conferees accept the report of the Technical Committee and refer it to the States of Michigan, Wisconsin and Minnesota for action to adopt water quality standards for the open waters of Lake Superior to supplement existing standards adopted for inshore waters. Such action should be substantially completed by the next session of this conference. Each of the States in the conduct of their public hearings are requested to invite participation of the Department of the Interior and other interested Federal agencies and the other Lake Superior States.

MR. STEIN: Thank you. I think that should be the recommendation of the conferees, with this addition.

The following--

"The members of the Technical Committee"--and list their names--"are to be commended for their diligent work and excellent report. The States and Federal Government are requested to keep these members available so that they may provide assistance and testimony in the process of considering their recommendations for adoption as standards."

O.K.?

Now we will go to what I think is the last point. This isn't a point yet, but we will bring it up. Every source here except Reserve Mining has had a time schedule and a requirement.

The next point is, and this is based on the report, "the Reserve Mining Company shall provide a specified method for abating its discharge to Lake Superior, which will meet State and Federal requirements, to the conferees through the State of Minnesota, by December 1, 1970. The conferees will then meet to see if this alternative is acceptable. The Reserve Mining Company will provide to the conferees through the State of Minnesota detailed plans and specifications for accomplishing this remedial program by May 1, 1971"--or let's say June 30--"May 1, 1971."

MR. BADALICH: Mr. Chairman.

MR. STEIN: Yes, sir.

MR. BADALICH: May I ask one question here for clarification?

You indicated May 1 for the method or alternate method of disposal, and so on, and then it would be referred to the conferees for their deliberation and study, and so on. Do you think that we can reach agreement, I hope, in the matter of just a few days or weeks or months so that the time schedule of June 30 will not be delayed?

MR. STEIN: Do you want June 30?

MR. BADALICH: You indicated May 1 or June 30. I am just wondering whether the conferees will be able to come to an agreement.

MR. STEIN: I think, the way I look at this, and we can do this at the time, unless--if we get a firm recommendation from Minnesota, I don't think the conferees are going to have much of a problem.

MR. BADALICH: All right, fair enough.

MR. STEIN: I really don't. You know, I say this to the whole world, I have been working with these people from these various States for years, and I tell you, if Minnesota or any of these other States give me a firm recommendation, as far as I can see, it is 99 and 44/100ths percent that we can go along with it. Unless we have a complete change of philosophy or personnel, I don't see that we are going to have any differences in the future that we haven't had in the past.

MR. BADALICH: O.K.

MR. STEIN: Because you people went to the same schools and had the same philosophy we did.

When do you want it, June? When? Do you want to move it back?

MR. BADALICH: No, I thought you--

MR. STEIN: Is May 1 all right?

MR. BADALICH: No, I thought you mentioned May 1 and then you mentioned June 30.

MR. STEIN: No, no, I said either one. The point is I was thinking in terms of six months from the December 1 for preparing final plans and specifications. Do you think that that--

MR. BADALICH: These are final plans and specifications--

MR. STEIN: Yes.

MR. BADALICH: --by May 1?

MR. STEIN: Yes, 1971.

MR. BADALICH: 1971.

MR. STEIN: And then I was going to propose--

MR. BADALICH: That is only five months.

MR. STEIN: --after that was in we would have another meeting. With the recommendation of the State of Minnesota, the conferees would all adopt the time schedule for letting of contracts and completion of the contract when we got the final plans and specifications, so you could make a judgment at that time as to what a reasonable time schedule would be.

Is this reasonable?

MR. BADALICH: Well, I think I might be a little confused now. We indicated that by December 1-- you are indicating now by December 1 that they shall have the preliminary plans for some method of alternate--

MR. STEIN: Preliminary plans, and that is in accordance with the statement that I understood Reserve to make.

MR. BADALICH: All right.

MR. STEIN: And six months from that final plans and specs.

MR. BADALICH: Which would be June 1, not May 1.

MR. STEIN: December 1. June 1.

MR. BADALICH: June 1--

MR. STEIN: All right.

MR. BADALICH: --for final plans and specifications on the alternate method.

MR. STEIN: And then we will meet again with a recommendation from Minnesota, after you have approved them, where you will recommend a time schedule for the letting of contract and the completion of construction and we will see if we will accept that. Because I think it might be speculative until you get the final plans and specifications to be talking in terms of the time schedule for construction and completion.

What do you think of that?

MR. BADALICH: Well, I think it might be a little tight schedule, Mr. Chairman.

MR. STEIN: What do you suggest?

MR. BADALICH: The only thing, to get from preliminary plans to final plans in six months might be a little hard.

MR. STEIN: What do you think would be appropriate?

MR. BADALICH: We generally allow in our program for compliance generally anywhere from nine months to a year, but maybe they can do it in this, I don't know.

MR. STEIN: Well, all right. Let me see, you want to-- I don't know what the other conferees think. Let's put this to them.

We have got six months, nine months or a year. What would you people think would be appropriate?

MR. MACKIE: I think Mr. Badalich is in the best position to judge this.

MR. STEIN: Mr. Badalich, could you give us your judgment after December 1 for final plans and specifications; could you give us a recommendation?

MR. BADALICH: Well, normally in our abatement procedures, Mr. Chairman, we allow nine months to one year for final plans after the preliminary plans have been approved by the Agency, but--

MR. STEIN: Would it be appropriate, in view of the pressure on this operation and the schedule that I see the other people moving along, for you to give nine months?

MR. BADALICH: I think that would be very realistic.

MR. STEIN: All right. So we have got June 1, July, August, September 1?

MR. BADALICH: Fine.

MR. STEIN: "By September 1, 1971, final plans and specifications. And at that time we will meet again, and presumably we might meet sooner and we may take some other action sooner if these dates are met, but if everything goes on schedule, and at that time Minnesota will have a proposal for the conferees on what it considers a reasonable time after September 1 for the letting of contracts and completion of construction."

Now, as a matter of fact, the reason I say about these others is when we get past that December 1 date, the rest of those dates are almost mechanical, because then it behooves the industry and the State and us and everyone else to do this as fast as possible, because no one is making any money after that.

Is that agreeable?

Yes.

MR. BADALICH: Pardon me, Mr. Chairman, I missed that question.

MR. STEIN: I think the crucial date is when you approve the plans and specifications, because as we know, it is like in a city, that once a--if the industry has approval of its plans and specifications, final plans and specifications, it probably has gone to whatever financial committee it has to get going to and have its money available, and it is to everyone's interest to get the thing built as fast as possible after that.

MR. BADALICH: Oh, I agree with you there. But I have to bear in mind the testimony of Reserve where they indicated it took them five years to design the original plant, although it certainly was the start of the taconite industry in Minnesota, but maybe now it can be done in a lot sooner time. But we are hoping that the nine months is realistic.

MR. STEIN: I think those four points are the points, but do you have any other things that the conferees want to bring up?

MR. BADALICH: Mr. Chairman, I have another point for consideration by the conference.

MR. STEIN: All right.

MR. BADALICH: I think it has been fairly well ascertained now that there is interstate pollution, but let's take it one step further, that if there is interstate pollution I certainly think there is international pollution, and I would like to reaffirm our request that we made at the original conference, and this was made by Governor Levander and is contained on page number 12 of Volume No. I, and also my statement on page number 342 of Volume No. II--that probably the greatest contributing factor to the Lake Superior pollution might be the Dominion of Canada. And I would like to see this conference make a recommendation to Secretary Rogers that the Lake Superior be made a reference with the International

Joint Commission.

MR. STEIN: Let me give you--and here the States probably can do more than I can. Let me make my position clear on this.

As far as this is concerned, Federal conferees are what we call in law _ultra vires_; it is beyond our authority. We can speak as to domestic matters. In the Federal Government the State Department speaks for foreign matters. And I think that this even--although some of the States have occasion and some of the Governors of the States have occasion, maybe even Governors representing States represented at this table don't quite recognize this, at least as Federal conferees we are bound by this, and I think this rule makes eminent sense, that we cannot get involved in international situations.

I will be glad, if the States recommend it, to carry this back to our Department and get this taken either to the State Department or the International Joint Commission or both and give your views on this, but by law the Federal people are just unable to participate in this, not that I wouldn't like to, but we can't. I would be glad to be a conduit and take this back to them, and I am sure I will represent you and represent your views to the best of my ability before the State Department and the International Joint Commission.

MR. BADALICH: Mr. Chairman, the reason I bring this up is because I remember the testimony just as recently as this morning and yesterday, we are talking about the total lake system, the total ecosystem, all these high-powered words of the scientists, and I think we shouldn't lose sight of this.

MR. STEIN: Well, do you want to make a recommendation that the States might agree to? And you can be sure, Mr. Badalich, that I will carry this forward. But I just say this is up to the States, and I regret that my oath of office and the law prohibits me from participating in this. But I surely can take your views forward and present them as forcefully as I can.

MR. BADALICH: Well, the only thing, I don't want to put or point the question to the States, but maybe--I would like to have a comment from possibly Wisconsin and Michigan on this matter. We have had very good relationships with the International Joint Commission on the Red River and the Rainy River, and I understand that Lake Superior is about the only lake in the Great Lakes that has not the IJC reference at this time.

MR. STEIN: Well, Lake Michigan; that is an American lake.

MR. MACKIE: Mr. Chairman.

MR. STEIN: Yes.

MR. MACKIE: If you are limited in what you can do here, I suggest perhaps that Mr. Badalich prepare a statement for signatures by all three Governors addressed to the Secretary of State and then we will transmit it together.

MR. STEIN: I think that-- What do you think of that?

MR. BADALICH: I will gladly do that.

MR. STEIN: I think that would be a very appropriate suggestion.

MR. BADALICH: I will certainly talk to the Governor on this and see that we get in touch with Governor Knowles and Governor Milliken.

MR. STEIN: May I go off the record here and make a suggestion to you? I will be glad to put it on the record if you like.

(Off the record.)

MR. STEIN: Let's go back on the record.

MR. MAYO: Mr. Chairman, just by observation, it would be wise to check with IJC on the procedural requirements for the submission of references. They do have some requirements.

MR. BADALICH: Yes, we will do that, Mr. Mayo.

MR. MAYO: This ought to be embraced in the original submission.

MR. BADALICH: Right.

MR. STEIN: Are there any other comments or questions?

MR. MAYO: Yes, my comment, Mr. Chairman, if in fact the IJC does take this up as a reference, it will be like a reconvening, almost, of the conferees at this session, if I would continue as Chairman for the Boards for IJC, the Advisory Board for IJC; Mr. Purdy is a member of the Boards, I think, for Lake Huron and the connecting channels. Aren't you?

MR. PURDY: There is no reference on Lake Huron. There is a reference on the connecting channels on Lake Erie and Lake Ontario.

MR. MAYO: Right. Mr. Frangos probably hasn't gotten involved yet. And I think Mr. Badalich serves as a member of the Advisory Board on the Rainy River?

MR. BADALICH: Right, the Red River.

MR. STEIN: Let me go off the record again.

(Off the record.)

MR. STEIN: Let's go back on the record.

MR. PURDY: Mr. Stein, I do have a couple of comments that I think are pertinent, but I do want to say that we felt your needle with respect to the State Department. The only thing is, in this case we needed to get something done and so felt it necessary to go around protocol.

In the one statement, I think it got a little bit long, on commending the States and Minnesota in particular for legal action that it has taken. I think one could interpret that the other two States have not taken legal action where necessary; and just as some shorter wording and as an alternate that you might consider as you review this record at a later point in time that possibly you could think about such wording as:

Commend the States for their programs to abate pollution of Lake Superior and in particular give special commendation to the legal action of the Minnesota Pollution Control Agency for enforcement of its water quality standards.

MR. STEIN: I would agree with that. And I would say particularly to Minnesota, I predicted that precisely this point would come up.

MR. BADALICH: Thank you, Mr. Purdy and Mr. Stein.

MR. STEIN: And I would agree with that.

MR. PURDY: And then with the statement with respect to the time schedule, I think you said "abate discharges," and I am wondering if that shouldn't be "abate pollution of Lake Superior" rather than "abate discharges"?

MR. STEIN: Well, "abate pollution," that is correct, right. Thank you.

Are there any other comments or questions?

MR. FRANGOS: Yes, Mr. Stein, just an observation or a footnote to these proceedings. I think my comments go to the integrity of the conference proceeding here. It has been my observation that this kind of an administrative mechanism usually results in more progress than using some of the other enforcement devices that are available to us, for example going into court and dragging some of these things through a lawsuit. I think that this has been a difficult area for all of the conferees because of the conflicts in the testimony. We have had the so-called battle of the engineers, the battle of the geologists; we had the battles of the economists and even the accountants. I think I ought to comment that we have just the highest regard for the performance of your laboratory staff here in Duluth, particularly that of Dr. Mount. At the same time I think we ought to indicate from at least our State's point of view that we also have the highest regard for the capability of Fred Lee, Dr. Lee, who is one of our own at the University of Wisconsin, and we have no question about his credentials.

On the whole, we had to survey a lot of data, a lot of testimony that was made. At least from the Wisconsin side of this thing we were particularly impressed by the public value on Lake Superior. And that value, it seems to us, is to maintain it in its pristine purity and minimize the aging process of the lake, and it is for that reason that we concur in the fundamental recommendation that we made as relates to Reserve Mining.

MR. STEIN: Thank you very much, Mr. Frangos.

I wish you would make that point clear that isn't quite understood back at our home base--that conferences such as this produce these results in complicated situations. People think in terms of black and white and these court cases as achieving it, and I think in a complicated situation like this I would certainly agree with you.

And I also appreciate your compliment when you talked about all these confrontations among the various disciplines but you didn't mention the lawyers. You know, we get along real well, and we don't have many confrontations.

I can't help remembering the case where that judge in Montana was trying a case and this gal was being tried for kind of being the loose woman in town. The lawyer looked around to the jury and said, "Did you ever have relations with that juror?"

And she said she didn't remember.

They went through the whole 12 and then the alternates, as many alternates as they had in Montana in those days.

And then finally he directed her attention to the bench and he said, "Did you ever have relations with his Honor, the judge?"

And she said, "I'll say."

And the judge leaned over to the reporter and said, "I want the record to show that when she had relations with the Court, she remembered it."

(Laughter.)

MR. BADALICH: Mr. Stein, as long as we are throwing out bouquets, I guess I have to really give a special commendation to you in giving us or affording us to use Dr. Mount, and especially Dr. Glass of his staff, in presenting and giving us the necessary scientific information in our present lawsuit at Two Harbors.

And with this, as I previously asked, are we going to ask Dr. Mount to provide any further statement on this matter of the scientific information that was brought forth?

MR. STEIN: As far as we are concerned, Mr. Badalich, and you know I have made several remarks before to your people and to people we provided for the case, I think it should be evident by now that with the resources we have provided for Minnesota I regard that we and Minnesota work in pollution control as one staff. We are backing Minnesota; we are backing Minnesota's program. When Minnesota has a case, and I might say this for any other State, within the limits of our resources and even beyond the limits you can be sure, as you are, John, you know when you call up I am going to do my best to present the witnesses, present the data, cooperate with you in any way we can.

Now, again I think, and this is the thing we have to look at, we recognize that the primary rights and responsibilities for pollution control rest with the States and the day-to-day operation of pollution control between the municipalities and industries of the State. When the State makes any demand which is at all reasonable, we are going to comply. If you want Dr. Mount or anyone else or any of the other States want them to provide backup information or support, if there is anything that I can do about it I am going to see that you get it.

MR. BADALICH: Mr. Stein, we really appreciate your support in this.

As a closing question I wonder, were you ever a judge in Montana? (Laughter.)

MR. STEIN: No.

Say, I have got another before you close. (Laughter.) We are keeping them here. I have got a real clean story about a judge in Montana.

He had an old bailiff leaning against the wall and there was one of these old frontier lawyers who, I guess, was in his seventies and kind of palsied. When they got through, concluded the case, he asked for proposed motions and this palsied lawyer began to write in a shaky hand. He wrote out his proposed motions and gave them to the judge, was kind of apologetic, and he said, "Your Honor," he says, "I don't know if you can read my writin'."

And the bailiff against the wall said, "Huh, he can scarcely read readin'."

(Laughter.)

With that, thank you all for coming and we stand adjourned.

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(Whereupon, at 3:50 o'clock, the conference adjourned.)